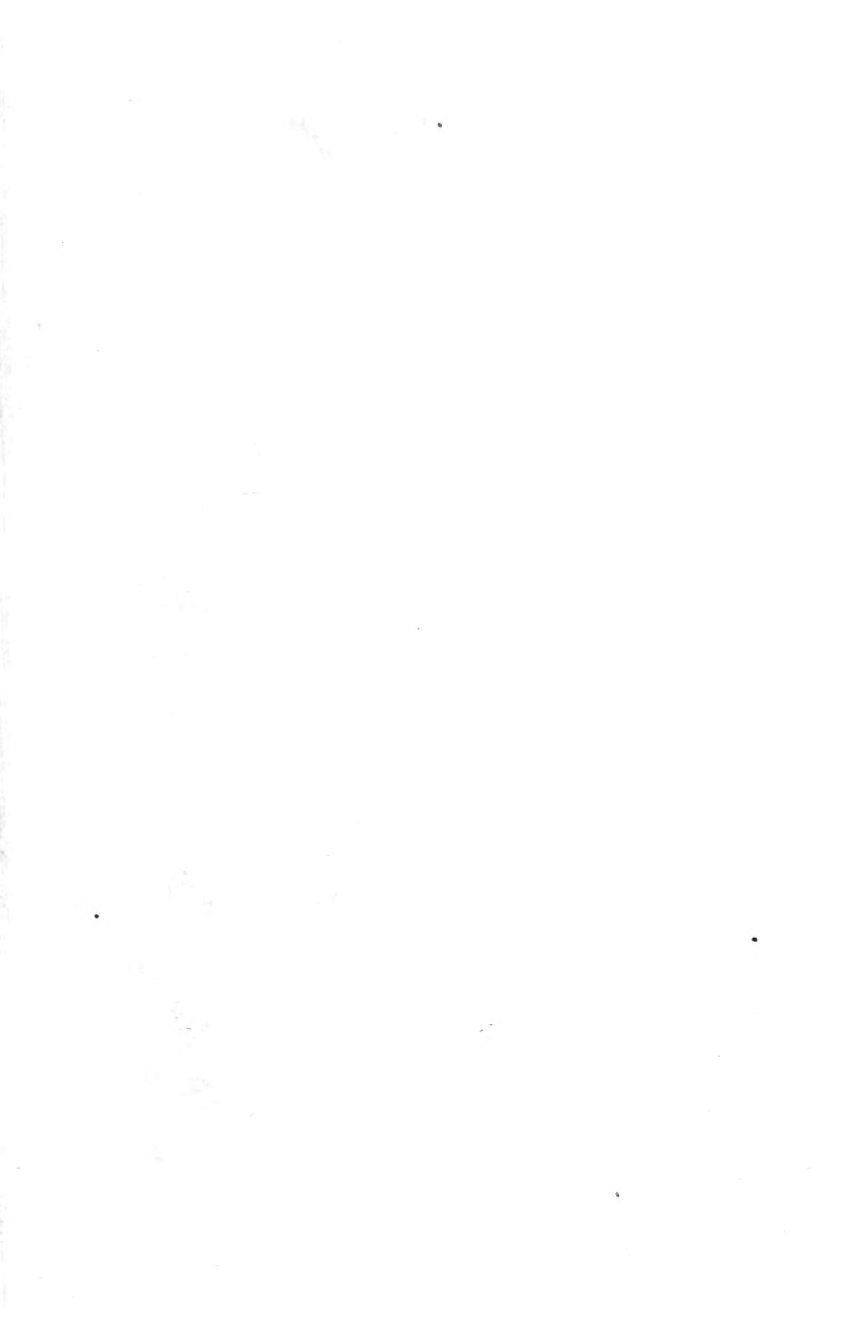


**THE PARAVANE
ADVENTURE
L. COPE CORNFORD**

Digitized by the Internet Archive
in 2008 with funding from
Microsoft Corporation





THE PARAVANE ADVENTURE

WORKS BY THE SAME AUTHOR

ECHOES FROM THE FLEET

THE LORD HIGH ADMIRAL

THE SECRET OF CONSOLATION

THE MERCHANT SEAMAN IN WAR

THE BRITISH NAVY: THE NAVY VIGILANT

THE FAIRY MAN



COMMANDER C. DENNIS BURNES, C.M.G.

ROYAL NAVY

THE PARAVANE ADVENTURE

BY
L. COPE CORNFORD

HODDER AND STOUGHTON
LONDON NEW YORK TORONTO

TO
THE PARAVANE OFFICERS
OF THE ROYAL NAVY

1914-1918

THE author desires to express his thanks to the Lords Commissioners of the Board of Admiralty, to whose courtesy he is indebted for permission to examine the records of the Paravane Department.

AUTHOR'S NOTE

Ex-Paravane officers who have kindly read the proofs of this book have suggested that the erroneous impression may be most unfortunately disengaged that more was effected by the Paravane in the submarine war than was in fact effected. The Admiralty have courteously raised the same objection, affirming that "the narrative ignores throughout every other factor which made for the defeat of the submarine and mine," such as the convoy system, regulation of merchant ship routes, minelaying, auxiliary patrols, mine-sweepers, the hydrophone, the depth charge, and "many other factors, for which could be claimed, as compared with the Paravane, a much more direct success in attacking the submarine." Quite true. I would however observe that I was writing, not about these other magnificent achievements, for which no praise can be excessive but, about the Paravane. I would therefore pray the reader to bear in mind the limitations imposed by the nature of my task, and to study the other aspects of the submarine war as already depicted by cleverer hands than mine.

Lest there should be any misunderstanding, I would say, further, that the information concerning each of the persons of this history, was given to me in every instance, not by himself but, by his colleagues. It is a narrative presented in reflecting mirrors. Even so, the officers on active service (with what I regard as an excessive modesty) insisted that they should be designated by initials alone. In the case of Commander Burney, as his name was already publicly associated with the Paravane in two continents, it was plainly foolish to suppress it, and for that reason he reluctantly withdrew his request. It remains to add that for the brief account of Commander Burney's financial arrangements in respect of his inventions, and for statements concerning Admiralty procedure, I am alone responsible.

L. C. C.

October, 1919.



INTRODUCTION

FOR some time before the conclusion of the Armistice, the present writer, as a student of naval affairs, could not but remark what was evidently a weakening of the German submarine offensive, and an absence of losses by mine. There were evidently forces at work of which he knew not, nor sought to know. But that a new spirit was abroad, the storming of Zeebrugge and the blocking of Ostend sufficiently demonstrated. Of the Paravane he had once heard the name, when the captain of a convoying cruiser told him that the boatswain complained that the Paravane 'caught fish.' Why the captain seemed to think the circumstance amusing, I did not know, having then no conception of the Paravane, nor did the captain explain.

When I read Admiral of the Fleet Viscount Jellicoe's history of the Grand Fleet during the first two years of the war, the contrast between the state of the Navy then, and its condition at the time of the surrender of the Imperial German Navy (which event I witnessed) insistently emerged. In the meantime, it had been officially announced that a real War Staff, with executive powers, had been instituted at the Admiralty, with the First Sea Lord as Chief of the Imperial Staff. Here was a reform which had been urged by Lord Beresford and others for five-and-twenty years. They had represented that there should be created at the Admiralty a body of officers whose sole business should be the study of the war; including the collation of intelligence, *the investigation of weapons and their application*, and the preparation of plans. These, broadly speaking, are the duties of a war staff.

After the conclusion of the Armistice, the present writer was privileged to read the following letter, written to the owners by the master of the ship. (The Otter to which he refers is the merchant service variety of the Paravane.)

H.M. HOSPITAL SHIP 'GOORKHA'

SALONIKA, 19th November 1918.

THE MANAGERS,

UNION CASTLE MAIL S.S. CO., LTD.,

3-4 FENCHURCH ST., LONDON.

GENTLEMEN,—I would like to pay a tribute to the efficiency of the Otter Gear as fitted to the *Goorkha*. The last minefield I passed through in daylight, the Otters cut adrift three enemy moored mines (in 15 minutes) which came to the surface just abaft the bridge. In dangerous areas, especially such as some of the pro-enemy waters we have to traverse just now, the Otters are more than ever necessary, and look-outs are placed in Nos. 5 and 6 boats to watch the water surface above the Otters. The patients (who are able) are kept on deck with lifebelts on, and the crew also, as far as possible. The tremendous tearing sound and vibration caused by the mine mooring wire rushing along the Otter towing wire, does not leave many of the crew in their

x THE PARAVANE ADVENTURE

quarters forward, and is felt quite strongly on the forecastle head. In the event of getting among mines, I see nothing for it but to steer a straight course, full speed if possible, as slowing down too much, or stopping, brings the Otters to the surface where they are useless, and turning under helm renders the stern liable to strike a mine, which the Otters have cut adrift. The very hard steel cutting teeth in the jaws of the Otter show little or no signs after cutting mine wires, although in one case, portions of the wire were found in the jaws, and in another a length of wire and the depth nipper were brought on board with the Otter. In another instance, the port Otter refused to work and came alongside ship, when it was found on hoisting it out of the water, that though it had cut the mine adrift, it had fouled the wire with some anchoring arrangement attached. The wire was cut with an axe, and the Otter freed. In most cases, the mines cut adrift by the *Goorkha's* Otters have very shortly afterwards been sunk by gunfire. In the Mediterranean from 28th June to 17th November, the ship steamed 1594 hours, during which time the Otters were in use 361 hours.—
Yours obediently,

(Signed) JOHN D. WHITTON.

At the same time, there were casually published in the Press some rather vague and obviously inaccurate references to the Paravane. Clearly the effect of this device (whatever it might be) had been considerable; and it occurred to the present writer that, if the Admiralty no longer desired to keep the matter secret, a precise account of the invention would both rightly inform the public, and affix the credit thereof where it was due.

He therefore wrote to the First Lord of the Admiralty on the subject, and the Board most courteously gave him access to the requisite information, stipulating that any technical description of the apparatus should be submitted to their Lordships before publication, and that the work should not be used as a text-book for officers.

Both these conditions have, of course, been observed, and the present writer desires to express his sense of the courtesy

and kindness of the Lords Commissioners of the Admiralty. It should, however, be distinctly understood that the Admiralty have no responsibility whatever for the statements in the book, for which the author is alone responsible.

In the course of his researches the present writer discovered that, as a matter of fact, the War Staff at the Admiralty had nothing to do with the invention or use of the Paravane, because the War Staff did not exist at the time. Had the War Staff existed, the story of the Paravane adventure might have been very different. As it was, the Paravane officers did in spite of the system, what a War Staff would have done by virtue of the system.

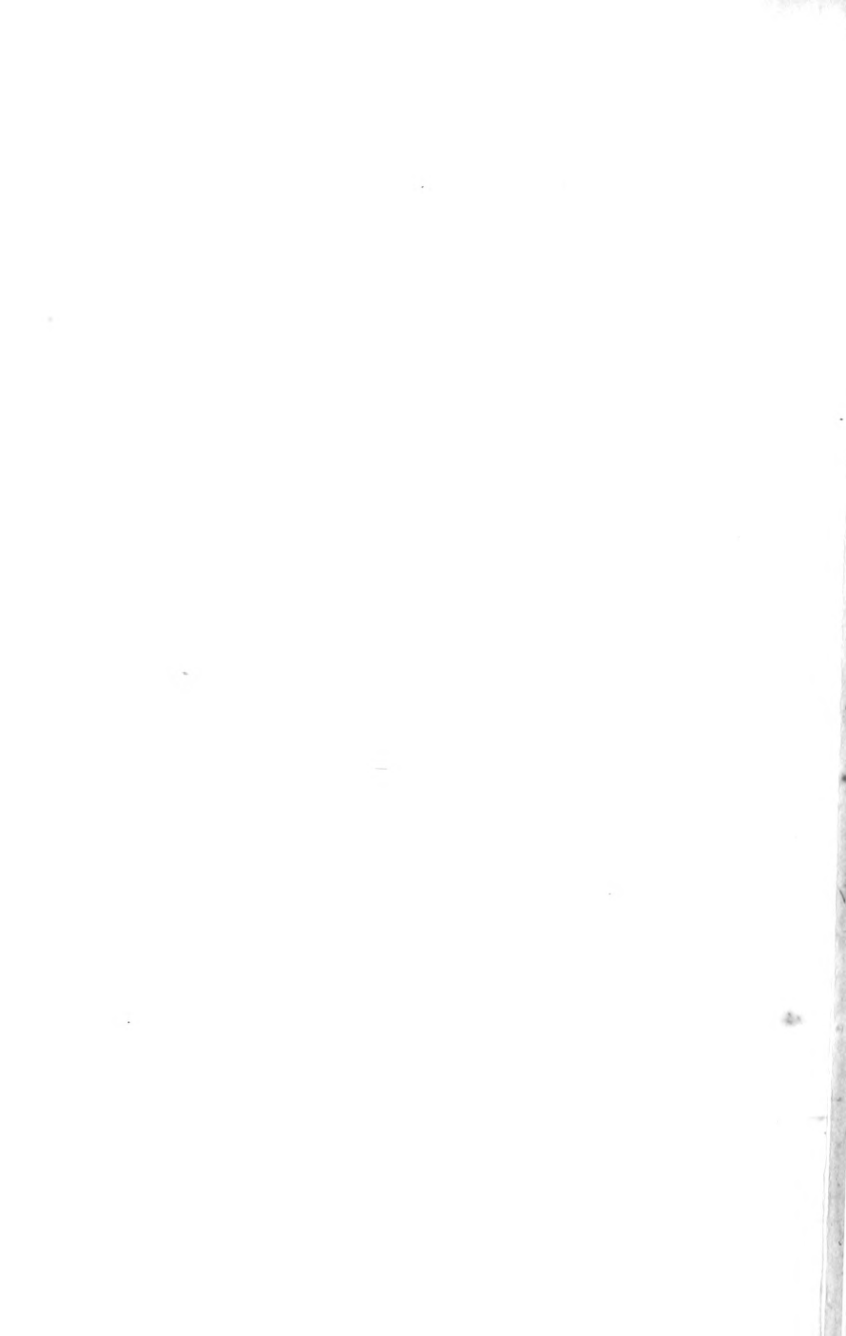
There is now a War Staff at the Admiralty ; but, it is officially stated, its organisation is not yet complete ; and times change ; and people forget. . . .

The history of the Paravane is the history of a romantic adventure, trium-

phantly achieved ; it is the history of a young officer of high inventive genius, who, loyally backed through foul weather and fair by his brother officers, proved that nothing is impossible to him who wills ; and it is also the most instructive example extant of the necessity for the maintenance of a permanent War Staff, in peace as in war.

L. C. C.

LONDON, *June* 1919.



LIST OF ILLUSTRATIONS

COMMANDER C. DENNIS BURNEY, C.M.G.	<i>Frontispiece</i>
	PAGE
GENERAL ARRANGEMENT OF HIGH SPEED SUBMARINE SWEEP, SHOWING AN EXPLOSIVE PARAVANE ENGAGING SUBMARINE	69
GENERAL ARRANGEMENT OF PROTECTOR PARAVANE	71
GENERAL ARRANGEMENT OF HIGH SPEED MINE SWEEP, SHOWING PARAVANE TOWING FROM STERN OF DESTROYER	74
STERN OF A DESTROYER UNDER WAY	76
Showing the towing-wire (electric) of the High Speed Submarine Sweep standing out from the fore-and-aft line of the ship as the Paravane tows. Looking aft over the Destroyer's starboard quarter.	
HIGH SPEED SUBMARINE SWEEP PARAVANE BEING HOISTED IN TO THE DROPPING-GEAR AFTER A RUN AT SPITHEAD IN A DESTROYER	76
AN OTTER BEING HOISTED IN	193
THE STANDING CUTTER ON THE TOWING-FRAME OF AN OTTER WITH THE TOWING-WIRE ATTACHED TO ITS UPPER JAW BY THE SPECIAL TOWING-SLEEVE FROM WHICH THE WIRE IS SEEN HANGING DOWN	193

The moorings of a mine encountered by this wire are automatically forced into the jaws of this cutter and are there cut by the serrated teeth of the knives which lie one in each jaw. With a magnifying glass these teeth can be clearly seen in the cutter jaws.

xvi THE PARAVANE ADVENTURE

PAGE

AN OTTER BEING HOISTED IN AT THE GALLOWES HEAD ON STARBOARD SIDE OF S.S. 'ACCRINGTON' .	208
--	-----

A MINE WHOSE MOORINGS HAVE BEEN CUT BEING SECURED TO THE GALLOWES IN S.S. 'ACCRINGTON' PREPARATORY TO HOISTING IT ON BOARD .	208
--	-----

TAKEN FROM THE FORECASTLE OF S.S. 'ACCRINGTON' LOOKING AFT ALONG HER STARBOARD SIDE .	241
--	-----

The ship is under way and her starboard Otter has just cut the mooring of a submerged dummy mine at which the ship was directly steered. The mine has been flung away from the ship, its moorings have then reached the cutter on the Otter and have been cut, and the mine is here seen leaping to the surface well clear of the ship's side.

AN OTTER BEING HOISTED OUT OVER PORT SIDE OF S.S. 'ACCRINGTON'	241
---	-----

TAKEN FROM THE FORECASTLE-HEAD OF S.S. 'ACCRINGTON' AT SPITHEAD, LOOKING AFT ALONG HER STARBOARD SIDE	256
---	-----

Showing the gallows fitted for hoisting and lowering an Otter; and the inhaul wire leading from it to the Otter running below the water.

TAKEN FROM THE FORECASTLE-HEAD OF S.S. 'ACCRINGTON' AT SPITHEAD, LOOKING AFT ALONG HER PORT SIDE	256
--	-----

Showing the gallows fitted for hoisting and lowering an Otter; and the inhaul wire leading from it to the Otter running below the water.

I

THIS is the story of how a group of young naval officers, during the Great War, matched their wits against the craft of the German and outwitted him.

The beginning of the story is really the Imagination of Lieutenant C. Dennis Burney; but it is better to start in the middle, that is, in February 1916, when there came to Scapa Flow two officers, Commander E. L. W., Royal Navy, and Lieutenant C. Dennis Burney, Royal Navy, bringing with them a Paravane. Exactly what is a Paravane will be explained presently. The two officers went on board H.M.S. *Iron Duke*, in which they were received by the Commander-in-Chief of the Grand Fleet, Admiral Sir John Jellicoe (now Admiral of the Fleet Viscount Jellicoe of Scapa).

2 THE PARAVANE ADVENTURE

The subject of the conversation which then took place in Sir John Jellicoe's cabin, between the Commander-in-Chief and Lieutenant Burney, is not on record ; but it may be deduced from the posture of affairs at the time.

During the previous year and a half, the British had lost, by enemy action and marine risks, about one million and three-quarters gross tons of merchant shipping, or about 250 vessels, and the rest of the world had lost over three-quarters of a million gross tons of merchant shipping, or about two and a half million tons in all. The Grand Fleet had no power to protect merchant shipping, other than the power it exercised of keeping the German ships of war in their ports ; for the Grand Fleet could deal neither with mine nor submarine. The Grand Fleet itself was continually hunted by submarines and perpetually in danger of crashing into unknown minefields. Lord Jellicoe's history of that time shows that the existence of the Grand Fleet was menaced by day and by night,

and that nothing but incomparable skill and vigilance saved it from disaster.

If the position is to be made plain, I must ask the reader to bend his patience to a very brief consideration of technical conditions. But first let us define our terms. Strategy means the act of bringing your forces into contact with the enemy. Tactics means the act of using your forces when they are thus brought into contact with the enemy. Both strategy and tactics depend upon the weapons in use on either side. If, for instance, there is a minefield between you and the enemy, you cannot get at him. Or if, when you have come within range of the enemy, he can torpedo you ere you can prevent him from so doing, your guns will be useless.

Now in the old wars, there was nothing to prevent you, if the wind served, from bringing your fleet into action with the fleet of your enemy. Nor was there anything to prevent you from cruising up and down outside his ports, thereby blockading

4 THE PARAVANE ADVENTURE

him. Therefore the principle of naval warfare was to maintain so powerful a fleet, that it could either bring the enemy to battle and defeat him, or shut him up in his ports. In either event, he could not interfere with the free passage of the seas. And to keep the free passage of the seas, while denying it to the enemy, is the object of naval warfare. The thing is so simple in theory, that many eminent persons who have read of it, think they can conduct a war at sea ; and so difficult in practice, that many a sagacious Admiral has failed to accomplish it.

When the mine, the long-range torpedo, the submarine, the flying ship and the aeroplane came to be employed by the Germans, the principles of naval warfare remained, but the old methods of carrying those principles into execution became partially nullified. And that disagreeable fact was exactly what Sir John Jellicoe perceived when he took command of the Grand Fleet.

The Grand Fleet was built, armed and

equipped and trained to use the old methods. These so far succeeded that the main German Fleet was held in check. But in the meantime quite another German Fleet was interfering with the free passage of the seas and bringing the war to the very doorsteps of these islands. To deal with the new warfare the Grand Fleet was helpless.

That, in brief, was the technical situation. And it is pleasant to remember that flushed old gentlemen on shore went about saying defiantly, ' Well, whatever happens, the *Navy* is All Right ! '

Whether or not Sir John Jellicoe thought the Navy was all right, may be deduced from his admirable book. It is another count to the credit of that great public servant, that when Lieutenant Burney arrived in the flagship bringing a new weapon with which to wage the new warfare, Sir John Jellicoe most carefully investigated its value, and gave his decisive support to Lieutenant Burney. That young two-stripe Lieutenant had produced

6 THE PARAVANE ADVENTURE

a device which, he said, would help to destroy the submarine and which would enable a ship to pass unharmed through a minefield.

I have begun in the middle of the story instead of at the beginning, because the approval of the Paravane by the Commander-in-Chief marks the culmination of what happened before, and made possible what ensued.

II

THE beginning of the story is the Imagination of Lieutenant C. Dennis Burney. We name that quality of mind, Imagination, by means of which man is enabled inwardly to see pictures of what has happened, what may happen, even what must happen, and what he wants to do or to make. All that man has made existed in his mind as a Thing—what the metaphysicians call a Thing-in-itself, by way of making it clear—before it existed in material substance. Very well: Lieutenant Burney could not help having imagination; but, like many other people, he might have refrained from the trouble of transmuting his perceptions into real things. The process is full of pain. It can only be accomplished by an indomitable tenacity. And imagination and tenacity are two gifts but seldom granted to one person.

Lieutenant Burney was that person. Like most pioneers, he was naturally devoid of respect for established authority, as such. It is indeed obvious that if the pioneer in any walk of this adventurous life here below were to respect authority simply because it was authority, and not because it manifested intelligence, he would never become a pioneer. And it is the first, elemental impulse of established authority to resist innovation.

For the sake of convenience, we will go back to the year before the war, in which Lieutenant Burney was inspired to predict what would happen if war came. His prognostication was contained in an article published in the *Review* produced by the Naval Society, for private circulation, of May, 1913. The idea upon which the article is based is that the object of war is to bring the most destructive weapon possible into contact with the enemy in the shortest possible time. Lieutenant Burney thought that in order to fulfil that principle, it was necessary to study weapons

and their uses. As, however, there was no department at the Admiralty especially charged with that duty, there was no reason why an officer should not conduct his own researches.

Lieutenant Burney foresaw that air power would in the future be one of the decisive factors in naval as in military warfare. At that time, the heaviest load of an aeroplane was about two tons. Airships had been built by Germany with a radius of action of 1500 miles, carrying capacity of forty men and speed of fifty miles. In this country there were no efficient large dirigibles. There was no defence against submarines.

Lieutenant Burney suggested in May 1913 that aircraft should be used to attack submarines, and that ships should carry aeroplanes, which should be fitted with wireless and should be used for attack, for reconnaissance and for scouting. 'On the one hand when used solely as a scout, they will enable us almost to eliminate the strategic advantages of the Kiel Canal,

and on the other, used as an offensive agent, they will enable us to defeat the submarine, and so free our fleets for action in the North Sea; and it is upon these two points and upon these two only, that Germany is at the present time placed in so favourable a position.' Considered in the light of the experience of the war, this is a remarkable passage.

Lieutenant Burney argued that 'the introduction of aircraft . . . tends for the first time in history to carry the offensive over the enemy's towns and ports, without first having to meet and defeat the enemy's craft. In short, *it means that our methods of offence are beginning to outstrip our methods of defence*, and when the meaning of this has been grasped, it will be seen that the whole art of war will be gradually revolutionised.'

During the war, it became painfully evident that the enemy's methods of offence had actually outstripped our methods of defence.

'It appears therefore that efficient air-

craft could practically bring the industries and communications of a country to a standstill, and in so doing make that country helpless. What does an invading army do but try to get all means of communication into its hands, and stop all distributions and industries in its wake? The invaders do not attempt to kill all the inhabitants but fight certain selected men of their opponents for positions, which enable them to dominate the lines of communication. With the introduction of aircraft this can be done without first gaining those dominant positions, and it is only necessary to send a sufficiently strong force of aircraft to destroy the enemy's communications. . . . Has a moral sense ever governed a nation's action when it is fighting for its existence . . . ?'

It may be noted at this point that in an official statement published in the Press of 20th April, 1919, the damage inflicted upon the City of London alone by twelve air raids, is estimated to average

£1,250,000 for each raid, or £15,000,000 in all. In none of these raids was a large force employed.

Lieutenant Burney was not alone in forming these conclusions. They were held by the Royal Flying Corps. Burney quotes a remark made by Major Sykes, Commandant of the Military Arm of the Royal Flying Corps (as he was then) in the course of a lecture. 'The navies of the world—I am sorry for them—but in my dream they have somewhat to relinquish their present proud position. Their *rôle* is that of floating defence. The Air Service is the foremost line.' 'Being a soldier,' observes Burney, 'he is quick to see how it will affect the Navy, but contends that it will not affect the *rôle* of the Army. Similarly, naval officers realise that land war is altered, but some are blind where their own Service is concerned.'

Burney's main purpose in setting forth these anticipations was to urge the construction of the hydro-aeroplane, a craft which should combine the qualities of an

aeroplane with the qualities of a seaworthy boat able to keep its speed in rough water, and which should be used for attacking submarines with gun and bomb, for reconnaissance and for scouting. Burney conceived that the hydro-aeroplane should be 'about four tons total weight, with a speed of between seventy and eighty miles per hour, carrying capacity for a crew of three men with the necessary navigational instruments, four or five hundred pounds of explosives, with a light gun for projecting them; a range of between 400 and 500 miles in the air, and 800 to 1000 miles on the sea and air combined; a sea speed of anything up to fifty miles per hour according to the state of the sea, and capable of being used for over 300 days in the year.'

At that time experiments were being made with such a type of vessel, and two years before (in 1911) an aeroplane had been constructed which left the water under its own power. It is not our present purpose to trace the development of the

hydro-aeroplane, but to note that in the course of his endeavours to build a practicable machine, which were inspired by a sense of the necessities of the times, and which were cut short by the outbreak of war, Burney gained a knowledge and an experience which enabled him to devise the Paravane.

The article in which Burney in 1913 forecast the developments of the war, unlike the brilliant prophecies of Mr. H. G. Wells or the late Lord Tennyson's glimpse of futurity, was, not an effect of pure fantasy but, the imaginative deduction from long previous study and industrious experiment. In 1910, Burney, then a sub-lieutenant, was appointed to H.M.S. *Crusader* for work on the Anti-Submarine Committee formed in that year, of which his father, Rear-Admiral (now Admiral Sir Cecil) Burney was the first president. The Committee studied both the development of the submarine and methods of defence against submarine attack. At that time, the theory was that submarines

were useful for harbour and coast defence, but that they could not be employed independently in deep water. It was, however, demonstrated by experiment that a submarine could navigate under her own power, proceeding far out to sea, attacking and torpedoing a man-of-war. To meet this new form of offensive, various methods of towing explosive charges were devised, which, by the time the war came, had developed into what was called the Modified Sweep. Young Burney, for the Committee, invented and conducted experiments, which were of course secret. In the course of these adventures, a submarine (without crew) went to the bottom and stayed there in an unknown position. Burney borrowed a primitive aeroplane in order to discover her position from above, and was thereby inspired to study aircraft.

In September 1911, he left the Anti-Submarine Committee, went on half-pay to pursue his researches at the experimental aviation works of Sir George White, at Bristol, and persuaded the Admiralty

to lend to him a torpedo-boat for use in the experiments in the development of the hydro-aeroplane. Here it falls to observe that the late Sir George White was a true patriot. He was a pioneer in scientific aviation, and spent money and time in research and experiment, without thought of gain.

Henceforward, for many months, though the Admiralty might move his body here and there, Burney's heart and mind dwelt in Bristol, bent upon the making of the seaplane.

For instance, in November 1911, the Admiralty mill ground out Burney's appointment to H.M.S. *Venerable*, in which ship he remained just long enough to apply for half-pay and to receive it, when he returned to Bristol. And in the following March, 1912, the Admiralty mill ground out his appointment to H.M.S. *Black Prince*, in which ship he also remained to apply for half-pay and to receive it, when he returned to Bristol.

During 1912 Burney joined H.M.S.

Excellent for the course in gunnery. Accordingly, he became a gunnery officer, in the intervals of Bristol. To Bristol he went every week-end, so arranging that the draughtsmen employed under his instructions should be at work during his visit.

Burney was then appointed to H.M.S. *President* for experimental work, and continued his experiments in seaplane construction and anti-submarine defence. During his time at Bristol, Burney, together with his technical collaborator, Mr. F. S. Barnwell, did in fact construct an efficient seaplane. He also acquired a professional knowledge of the science of aviation, and learned the methods and office routine of a private commercial firm (which differ extremely from Government methods), attainments which in the future were to serve him well.

But Lieutenant Burney was now a gunnery officer, and four months before war was declared, he was appointed according to the usual procedure to the Chatham

Gunnery School as instructing officer. And he continued to spend his week-ends at Bristol.

Early in 1914, representatives of the Royal Naval Air Service witnessed the first official trial of the Burney hydro-aeroplane, or seaplane, at Pembroke, where the Senior Officer was generously directed by the Admiralty to render every assistance 'at Lieutenant Burney's expense.'

Shortly afterwards, the war put an end to Burney's experiments in the design of aircraft. So far, Burney had equipped himself with a specialist's knowledge of the design, construction and use of submarine vessels, had devised methods of defence against submarine attack, had mastered the principles of aviation, and had done much practical inventive construction of aircraft. These things he had accomplished entirely of his own initiative. It was of course not the part of the Admiralty to encourage young officers to adventure outside the scope of their duties. As an Admiral once said to the present

writer, young officers are not paid to think.

Upon the outbreak of war, Lieutenant Burney was appointed to the command of H.M.S. *Velox*, torpedo-boat destroyer, in the Channel patrol, based upon Portsmouth, where Admiral of the Fleet Sir Hedworth Meux was Commander-in-Chief.

III

WHEN war came, the British public held a sublime and apathetic confidence in the British Navy which endured to the end. And in so far as the skill, tenacity, valour, and seamanship of the Fleet were concerned, that confidence was absolutely justified. The preparation, organisation and direction of the Fleet, apart from its conduct at sea, were another matter, of which the public, fortunately for their composure, knew and were permitted to know, nothing. Not until the publication of Admiral of the Fleet Viscount Jellicoe's book, in February 1919, did the country begin to understand the frightful perils from which it had been saved. How it was saved it is the purpose of this book to show.

In *The Grand Fleet, 1914-16 : Its Creation, Development and Work*, Lord Jellicoe

indicates plainly enough that, had the German High Seas Fleet challenged a general action early in the war, the British Fleet might well have been defeated; for had Germany attacked when the usual proportion of British vessels were absent from the Fleet, obtaining fuel or under repair, the High Seas Fleet would have been equal in strength to the British Fleet in capital ships, and in destroyers greatly superior. The German High Seas Fleet was safely in harbour, whence it could come at any moment. The British Fleet was constantly at sea, destitute of a defended harbour; exposed by day and by night to submarine attack; and in danger of destruction by mine.

From the beginning, the Germans employed the new weapons of the mine and the long-range torpedo, which is fired both from the destroyer and the submarine. The Grand Fleet had no harbour in which it could safely lie. Had a single submarine penetrated the makeshift defences of Scapa, it might have destroyed the British

superiority in capital ships. The Grand Fleet, perpetually hunted by submarines, retreated to Lough Swilly, there to remain while defences were erected at Scapa, and returned to Scapa to find the barrier unfinished.

Against the mine there was no defence. Against the submarine there was no defence, other than a screen of patrolling destroyers, always numerically insufficient, and the device of manœuvring at high speed. The use of the mine as a method of warfare had been constantly considered by the staff of H.M.S. *Vernon*, but the Government invariably refused to grant the money requisite for experimental work. The coast defence mining section of the Navy had been abolished, and the mining branch of the Fleet was utterly inadequate.

Theoretically, the business of the Grand Fleet was to seek out and destroy the Fleet of the enemy, and in the meantime to enforce the blockade. With the secondary war upon commerce conducted by the

enemy, the Grand Fleet had nothing to do. The theory of naval warfare thus embodied, was traditional. It was far from covering the exigencies of modern war; but such as it was, the theory had never been carried into practice. For the Grand Fleet was utterly unprepared for its task. It was deficient in numbers of officers and men; it was deficient in numbers of vessels; it was deprived of protected bases; it was short of docks; there was no adequate organisation of coal and oil and auxiliary vessels; and the technical equipment of ships was inferior to the German equipment. All these things and more are described by Lord Jellicoe, without comment. These vast deficiencies must be made up by improvisation. 'Improvisation,' remarked Sir Douglas (now Earl) Haig, 'is never economical and seldom satisfactory.'

But during the first two years of the war, no improvisation had restored to the Fleet the freedom of movement of which it was deprived by minefields. Mines

might be swept but they were laid again. Nor had any improvisation quelled the submarine. It would appear that it was first the determination of the Admiralty to conduct the war at sea upon the assumption that the submarine was comparatively harmless.

In August and September, 1914, 217,108 gross tons of British and foreign merchant shipping had been lost by enemy action and marine risks. The number of British steamships over 1600 gross tons lost was 31. But these losses were considered negligible. They did not, it was said, affect the conduct of the war.

Then, on 22nd September 1914, the three armoured cruisers, *Aboukir*, Captain John E. Drummond, *Cressy*, Captain Robert W. Johnson, and *Hogue*, Captain Wilmot S. Nicholson, were sunk by submarine. They were cruising in company and were put down one after the other with dreadful loss of life.

IV

BURNEY'S position at this moment was near desperate. He had no money to spend upon that most costly of occupations, invention ; he had no time, his days and nights being consumed with his duties as captain of a patrolling destroyer ; and those duties were often highly exhausting. He was a Lieutenant, and therefore, according to the etiquette of the Service, so low in the scale of created beings, that he was hardly entitled to an opinion of his own, still less to express it. All these things were against him.

On his side, was the reputation he had earned by achievement in submarine and hydroplane experiment. And also on his side was the Commander-in-Chief of Portsmouth. That distinguished officer is a man of affairs as well as a seaman, and in

both spheres accustomed to have his way.

Now the problem to whose solution Burney again set his mind, was how to attack and destroy the submarine below the surface. A submarine on the surface can be tackled with the gun. A submarine below the surface must first be detected. Therefore it was necessary to discover something which could detect the submarine under water, and when it was detected, destroy it. That something must be attached to a ship and worked from a ship. Explosive charges towed from the stern of a destroyer had proved comparatively ineffective, and in any case, the number of destroyers available for submarine pursuit was very few.

It is obvious to the least initiated that a towed body tends perpetually to come to the surface, and that any alteration of speed or course on the part of the ship towing, will alter the depth of the body towed. The difficulty is partly met by the device of the otter-board used by

trawlers to keep their nets down, but the otter-board alone was useless for the purpose required.

Therefore the problem to be solved might be stated thus:—*To keep a body, containing the requisite explosive or appliance, towing at a constant depth unaffected by any variation of speed or of helm.*

By the orders of the Commander-in-Chief of Portsmouth, Burney was attached to H.M.S. *Vernon* torpedo school, for experimental purposes, while remaining on patrol duty in *Velox*, an arrangement which in practice enabled Burney to conduct experiments in *Velox*. He proceeded at first upon the hydro-aeroplane principle, devising a towed surface-hydroplane body based on his experiments made at Bristol. In September, Burney submitted his scheme through H.M.S. *Vernon*, asking for authority to arrange that the requisite experimental wooden bodies should be made in Portsmouth Dockyard and to purchase six planes from Sir George White at Bristol. The request was officially

approved on 9th October 1914. But in the meantime, in order to avoid delay, Sir George White had sent the planes, which had been removed from Burney's model at Bristol for the purpose, to Burney at Portsmouth ; Burney had contrived to secure the wooden bodies, to finish an experimental machine, and to complete its trials, so that by the time official approval was received, the thing was done.

At this point in the narrative, emerges that contrast between individual initiative and official procedure, which will become more and more insistent. The methods of the Admiralty, like the methods of other great Departments of State, are, and perhaps must be, stereotyped to operate in rigid grooves. And at this point, Burney, who had his own views as to the urgency of the situation, began to take a personal responsibility involving his own fortunes in some hazard, albeit in this first instance the risk was trifling enough. Burney merely anticipated official approval, and in its appointed course it duly arrived.

On the 8th October, the day before the official assent was received, a description and drawings of the new gear were submitted to the Admiralty by H.M.S. *Vernon* with a request that complete drawings should be prepared by Portsmouth Dockyard. The request was approved and the drawings were made by the Dockyard draughtsmen under Burney's direction. The Dockyard was of course very busy and found it difficult to take on more work, but inside a month the drawings were submitted to the Admiralty together with a description of the gear, and an account of its trials in *Velox* and proposals for future development. The Admiralty authorised the manufacture in the Dockyard of one set of gear and the continuance of the trials in *Velox*.

The gear was made and was subjected to further experiments, when it was found that the surface-hydroplane body might be eliminated. The Admiralty were informed of the proposed modification on 25th January 1915.

Burney, having discovered that the surface-aeroplane body was superfluous, and having reported the fact, went steadily on with his experiments, while his report was proceeding through the Admiralty. Presently he succeeded in devising what was, in fact, a submarine aeroplane, a torpedo body fitted with a plane, which would tow outwards from the ship's side and which would keep down below the surface at a depth unaffected by the speed of the ship.

This invention, clearly of the first importance, was reported to the Admiralty by H.M.S. *Vernon* early in February. A few days later, two Admiralty letters were forwarded to Lieutenant Burney for his information. Both bore the same date. One directed the Commander-in-Chief of Portsmouth to stop all experiments. The other directed the captain of H.M.S. *Vernon* to go on with them. The explanation of what was apparently a contradiction is probably simple, but it was not apparent; and when Burney received

copies of the two letters, one saying no and the other yes, he naturally sought the advice of the Commander-in-Chief, Portsmouth. Sir Hedworth Meux, who had helped Burney from the first, and who also appreciated the gravity of the submarine peril, sped to the Admiralty, and obtained their Lordships' sanction for the making of the new gear at Portsmouth for purposes of experiment.

The gear was fitted in H.M.S. *Mastiff*, t.b.d., and was tested at Harwich by Commodore (T). In May 1915, the Commodore in his report expressed the highest approval of the invention, which, he considered, would be a most effective weapon in dealing with submarines.

This was the first Paravane.

V

AFTER seven months' tense and unremitting labour, Burney had solved the main difficulty of his problem : to keep a body, containing the requisite explosive or appliance, towing at a constant depth, unaffected by any variation of speed or of helm. The Paravane was still far from perfect, but it would work. So much had Burney accomplished since the sinking of the three cruisers. All day he was at sea in *Velox*, experimenting with wooden models, noting defects and inventing remedies ; when he landed, he must instruct the draughtsmen in the Dockyard, and go round the shops to supervise the making of the models ; during the evenings and half the night he was designing, calculating, and framing reports.

In the meantime, how went the war ?

In September 1914, the three cruisers had been put down ; on 1st November, the British squadron under the command of Rear-Admiral Sir Christopher Cradock had been defeated ; on 5th November, Great Britain declared war on Turkey ; on the 8th December, Vice-Admiral Sir Doveton Sturdee avenged Cradock off the Falkland Islands ; on 1st January, 1915, H.M.S. *Formidable*, Captain Arthur N. Loxley, had been torpedoed in the Channel ; on 24th January was fought the naval action off the Dogger Bank ; on 25th February, the Allied Fleets had attacked the Dardanelles, serious losses ensuing. And in the same month Germany proclaimed the submarine blockade of this country, officially announced as follows :—

1. The waters round Great Britain and Ireland, including the English Channel, are hereby declared a military area. From February 18th, every hostile merchant ship in these waters will be destroyed, even if it is not always possible to avoid thereby the dangers which threaten the crews and passengers.

2. Neutral ships will also incur danger in the

84 THE PARAVANE ADVENTURE

military area, because, in view of the misuse of flags ordered by the British Government on January 31st, and the accidents of naval warfare, it cannot always be avoided that attacks may involve neutral ships.

3. Traffic northwards around the Shetland Islands, in the east part of the North Sea, and a strip of at least thirty sea miles in breadth along the coast of Holland is not endangered.

(Sgd.) VON POHL,
Chief of Admiralty Staff.

The blockade of Germany by Great Britain was not at that time, and not until long afterwards, strictly enforced. And while the British public believed that Great Britain was blockading Germany, what was really happening was that Germany was blockading Great Britain. The British Navy was doing its duty; suspected ships were duly sent into port; but all save a small percentage were released by order of the Government. Germany, however, meant business.

To show how that business was done, I give here some examples, taken from my

book¹ on the subject, which, by the courtesy of the Admiralty, I was enabled to compile from the official records.

‘In the grey noon of an October day the *Glitra*, an old, small iron steamship, was approaching the harbour of a neutral country, whose tall headlands loomed ahead. So far the master, following the directions of the Admiralty, had brought his ship scatheless. Within an hour or two she would be safe.

‘The master and the chief officer were on the bridge, and an able seaman was posted as lookout on the forecastle head. Up went the flag calling for a pilot, and presently the master descried the pilot’s motor-boat swiftly approaching from the shore. At the same moment he perceived a long and low object moving towards him on the water some three miles to seaward. The apparition was like a blow over

¹ *The Merchant Seaman in War*. With a Foreword by Admiral Viscount Jellicoe. (London, Hodder and Stoughton.)

the heart to the men of the *Glitra*. But it might be a British submarine. The master, staring through his glass at the flag flying from the short mast of the nearing vessel, made out the black German eagles. The pilot saw them too, for he went about, heading back to the harbour; and with him the men of the *Glitra* beheld their last hope for the ship implacably receding, and confronted the inevitable with the dogged composure of the British seaman.

‘The master altered course, steering away from the submarine, which, fetching a wide circle, drew towards the *Glitra*. The submarine had the speed of the old cargo-boat, and as she came closer the master heard the metallic ring of tube-firing, and a flight of small shot sang about his ears. Thereupon he stopped his engines, and the *Glitra* lay still, while the submarine drew nearer and stopped within a ship’s length of the steamer. There she lay, the water lipping on the rounded hull, from which the conning-tower rose amidships. The commanding officer stood by

the rail of the conning-tower, and men were descending thence to the narrow platforms fore and aft, and busying themselves on the deck. Then the submarine hoisted the code signal, meaning "drag-rope"; and the men on board the *Glitra* saw the Germans get a collapsible boat into the water. Two men pulled, and a third sat in the stern-sheets.

'The men of the *Glitra* awaited events in silence; and the next thing of which the master was acutely conscious was the cold muzzle of a revolver pressing into the flesh of his neck, while the excited German officer wielding that weapon ordered him in throaty but intelligible English to leave his bridge and to get his boats away in ten minutes, as his ship was to be torpedoed.

'The master, going down on deck with a disagreeable sensation as of a pistol aimed at his back, mustered the silent crew, who assembled under the hard eyes of three Germans covering them with revolvers, and who at the same time beheld

two guns on the submarine, one forward and the other aft of the conning-tower, trained expectantly upon the ship. Then the master, looking directly at the small black circle of the revolver's muzzle, was ordered to haul down his flag. Still followed by the revolver, he went to the halliards and dropped the flag to the rail, over which it hung drooping and disconsolate. And then he was ordered to fetch the ship's papers which are the most sacred trust of the master of a vessel. Down below he went, with the pistol at his back ; and no sooner had he vanished down the companion-way than the German officer seized the flag, tore it across and across, flung the pieces on the deck, and stamped upon them like a maniac. The master came on deck to witness the remarkable spectacle of an officer of H.I.M. Imperial Navy wiping his sea-boots on the Red Ensign.

‘The German, having thus gratified his emotions, again turned his revolver on the master, ordered him to hand over the

ship's papers, forbade him to fetch his coat, and refused to allow the crew, who were sullenly launching the three boats, to get any additional clothing. Then the German officer ordered the three boats to pull to the submarine and to make fast to her.

‘The men of the *Glitra*, fetching up alongside the submarine, gazed curiously upon the dull, rigid faces of the German blue-jackets, and marked the strange and ugly form of the Tinfish, as the merchant service calls it. So soon as the boats were made fast, the submarine, with a grinding noise like the working of millstones, drew off about a ship's length, towing the boats, and stopped again. During this time the master, scanning his lost ship intently, saw the three Germans left on board her hurrying to and fro, taking his charts and compasses and lowering them into their own boat. Then one of them, supposed by the master to be an engineer, went below. Presumably the German turned on the sea-cocks, for the master presently

observed the *Glitra* to be settling down by the stern.

‘It was then about a quarter of an hour since the crew had quitted the *Glitra* ; and the commanding officer of the submarine ordered the master to cast off and to proceed towards the land.

‘As the boats drew away from his ship, lying deserted and sinking lower into the water, the master, watching, perceived the dim shape of the submarine still circling about her, like a sea-beast of prey. Gradually the boats drew out of sight of the last scene.

‘The men had been rowing for about an hour when the pilot-boat came up and took them in tow. Then the men of the *Glitra* were taken on board a neutral ship of war. The master of the *Glitra* and the crew, thus stranded in a foreign man-of-war with nothing in the world except what they had on, heard the growl of guns rolling from seaward, where the submarine was working her will on the desolate ship.

‘The capture and destruction of the

Glitra marks an early stage in the evolution of the German pirate. The destruction of the ship in default of having brought her before the Prize Court of the enemy, was a violation of international law, which might, however, be defended on the plea of necessity. The refusal to permit officers and men to take with them their effects was an infraction both of universal rule and of the German Naval Prize Regulations of 1914. On the other hand, it may be contended that the enemy did in fact place the crew of the captured ship in safety.

‘The British were threatened with revolvers, and guns were trained upon them, but these weapons were not fired, and no one was injured. In his later stages the German pirate observed no such restraint. As for the insult to the British flag, while it may have been the result of an unpleasant personal idiosyncrasy, it is also significant of a mental condition prevailing among German officers, of which examples subsequently multiplied.’

‘ On November 23rd, 1914, the little cargo boat *Malachite*, four days out from Liverpool, was drawing near to the French coast. It was a quarter to four in the afternoon ; the ship, rolling gently to the easterly swell, was within an hour or so of Havre, which lay out of sight beyond Cape La Hève, darkening in the haze some four miles distant on the port bow. The master and the mate, who were on the bridge, descried the indistinct form of a long and low vessel lying about two miles away on the starboard beam. As they looked, the mist clinging about the unknown craft lit with a flash, followed by the report of a gun, and a shot sang across the bows of the *Malachite*. Then the two officers on the bridge recognised the vessel to be a German submarine. The first that the men below in the engine-room knew was the clang of the bridge-telegraph and the swinging over of the needle on the dial to “stop.” They eased down the engines, and as the ship lost way, they heard two long blasts of the steam

whistle sounded on the bridge. Then silence, the ship rolling where she lay.

‘The master and the mate, standing against the bridge-rail, contemplated the approach of the submarine. The German officer and the quartermaster were on the conning-tower. Aft of the conning-tower, on deck, a seaman stood beside a small gun, which was fitted with a shoulder piece. The submarine drew close alongside the *Malachite*, and her officers looked down into the eyes of the German naval officer, and the German naval officer looked up at the two British seamen. These knew well enough what to expect, and merely wondered in what manner it would arrive.

‘The German officer was polite but business-like. Where have you come from? Where are you going? What is your cargo? These were his questions, framed in that school English which for many years every German midshipman has learned as part of his pass examination, in order that he may communicate with the conquered race of Britain.

‘The master gave the required information. He could do nothing else. Then the submarine officer gave an order, and a sailor ran along the deck of the submarine and hoisted the German ensign on the short mast mounted aft. All being now in order, the submarine officer requested the master of the *Malachite* to prepare to leave his ship at the expiration of ten minutes, and to bring with him the ship’s papers.

‘The master, mustering the crew, got away the two lifeboats, and fetched his papers. The two boats came alongside the submarine; and now the submarine officer gazed down at the stolid British seamen, who were utterly in his power, and they stared curiously up at the trim and easy German.

‘The master, handing over his papers, since there was no help for it, asked that the ship’s log and the articles might be given back to him. The submarine officer declined to grant the request. Then he added, “I am sorry I cannot accommo-

date you and your crew, but war is war."

' Then he told the master to stand clear, and as the two boats hauled off, the submarine got under way. The men in the boats, resting on their oars, saw the submarine open fire on the *Malachite* at a range of about 200 yards, saw the shot strike the ship at the base of the funnel, and a hissing cloud of steam and smoke enshroud her, saw shot after shot pierce the hull, and the ship begin to settle down by the head.

' Darkness was gathering, and the fog was closing, when the master ordered the men to give way, and steered towards Havre. As they pulled through the gloom, the men in the boats heard the intermittent bark of the gun sounding from seaward. After about three quarters of an hour there was silence.

' They came into Havre Harbour at half-past eight, after a pull of some three and a half hours. Subsequently they learned that the submarine, having fired the ship,

left her, and that she remained afloat all that night and the next day.

‘The taking of the *Malachite* is typical of the end of the first phase of submarine warfare; the phase in which the German officer, individual acts of brutality apart, at least recognised the existence of the law of nations, used a certain consideration for the crews of captured vessels, and was occasionally even courteous. On the other side, merchant ships were still totally defenceless; and sometimes, as in the case of the *Malachite*, were taken within sight of land and close to a port of arrival.’

‘The *Tokomaru* was a steamship of nearly 4000 tons register, had left Wellington, New Zealand, and had touched at Teneriffe, which port was swarming with Germans. The *Tokomaru* lay at Teneriffe for eleven hours, during which time many shore boats came alongside. The visitors could easily have ascertained her destination. Whether or not that circumstance was related to her destruc-

tion was not known. Teneriffe belongs to Spain.

‘ Like the *Malachite*, the *Tokomaru* was bound for Havre. Off Ushant she spoke a French man-of war, giving her name and destination. At about nine o’clock on the morning of Saturday, January 30th, 1915, she was within seven miles of the Havre lightship. Somewhere on the sea-floor beneath the *Tokomaru’s* keel lay the bones of the *Malachite*. It was a fine, clear morning, the land mistily sparkling beyond the shining levels of the sea. Some of the crew were busy about the anchors, preparing to moor. The master and the second and third officers were on the bridge. An able seaman was posted on the forecastle head, looking out. Between the ship and the shore a French trawler was steaming about her business.

‘ Without any sign or warning a tremendous blow struck the ship on the port side with a loud explosion, and a column of water, rising to the height of the funnels, descended bodily upon the three officers

on the bridge, swept along the decks, poured down the companion-ways, and filled up the stokehold. The ship leaned over to port, and officers and men felt her settling down under their feet.

‘Several things happened simultaneously. The master, cool and composed, looking seaward, perceived a little hooded dark object cleaving the surface about 600 yards away on the port beam, and, making a path from it to the ship, irregular, eddying patches of foam. There, then, was the submarine and there was the track of her torpedo, ending in a spreading inky patch of water about the ship, where the sea was washing the coal out of the bunkers. Even as the master ordered the boats to be manned, the periscope of the submarine disappeared. At the same time the wireless operator, shut up in his room, was making the S.O.S. signal, and the French trawler in the distance began to steam at full speed towards the ship.

‘Owing to the list of the vessel the falls of the boats jammed. The crew cut the

ropes, hammered away the chocks, and stood by quietly awaiting the order to launch. They were all wet through, for those on deck had been smothered in the falling water, and those below had struggled up the ladders, against descending torrents. There they stood, the deck dropping by inches beneath their feet, and tilting towards the bows, until the sea was washing over the forecastle head, when the master ordered them into the boats. The master was the last to leave the ship. His cabin being full of water, he was unable to save the ship's papers and money. Sixty-two pounds belonging to the owners, and about seventeen pounds belonging to the master himself, were lost.

‘By this time the French trawler had come up, and the officers and men, fifty-eight all told, were taken on board. The trawler stood by, while a flotilla of French torpedo-boats, arriving from Havre with several trawlers, steamed swiftly in circles round the sinking ship, in order to guard against a renewed attack.

‘ At half-past ten, about an hour and a half after she was torpedoed, the *Tokomaru*, with her cargo of general goods and fruit, went down in a great swirl of water. When it had subsided, the trawler moored a buoy over the spot, and took the *Tokomaru*’s people into Havre.’

‘ The little steamship *Downshire* was small game, but the Germans are nothing if not thorough. The case illustrates to what extent, in these early stages of the war, the master felt he could act on his own responsibility. He went as far as he could. The German officer, although, in sinking the *Downshire*, he was committing an act of piracy, behaved with courtesy and consideration, and spoke “ in perfect English.”

‘ The *Downshire* left an Irish port early in the afternoon of February 20th, 1915, and by half-past five, in a clear and calm twilight, she was eight or ten miles from the English coast, steaming at about nine knots, when the master perceived a sub-

marine. The enemy vessel was running on the surface, nearly two miles away on the starboard bow, and heading for the *Downshire*.

‘The master instantly altered course to bring the submarine astern of the *Downshire*, ordered full speed, and roused out all the men, ten in number. The submarine also altered course and began to chase, rapidly overhauling the *Downshire*. At a range of about four hundred yards the submarine opened fire from the machine-gun mounted on her deck.

‘Here was a pretty situation for the peaceful master of a little trading coaster. He kept his wits about him, and his eyes on the enemy; and, continuing to manœuvre his ship to put the submarine astern, swiftly reckoned his chances. People think, not in words, but in pictures, dim or clear. The sharper the emergency, the more vivid the picture. The master, never shifting his steady seaman’s gaze from the submarine gaining hand over hand astern, beheld with his inward eye

the pieces of his problem sliding together and slipping apart again as he bent his mind to fit them to a pattern.

‘He foresaw the submarine, with her turn of speed, drawing so close alongside that, as the machine-gun crackled and spat, his men would be struck down ; he foresaw the long fifteen miles to the nearest port, partly as measured on the thumb-stained chart, partly as a seascape of deep water, in which the submarine could venture all the way, knowing that she could safely submerge at any moment ; he foresaw his ship, shoving for safety under continuous fire for an hour and a half, splinters flying, men rolled on the deck ; he may even have seen himself, crumpled up beside the wheel, and a darting vision of the ship being taken after all ; he imagined the coiling track of a torpedo whitening towards him, and foretasted the ultimate explosion ; and at the same moment he reckoned the chance of the torpedo striking a hull drawing four feet six inches forward and ten feet six inches

aft, and perceived that the torpedo might pass under the keel, and also that it might not. . . .

‘In the meantime the submarine was still gaining on the *Downshire*. She fired a second shot. The master, with his problem now resolved into a grim pattern whose significance was imperative and inexorable, may or may not have considered the possibility of ramming the submarine. He had no instructions on the subject. But if he did consider that possibility, he must also have foreseen that if he failed in the attempt, the submarine would certainly try to torpedo him. If the torpedo hit, all was over. If it missed the enemy would give no quarter.

‘The submarine fired a third shot at close range. That settled it. The master had held on as long as he could. Utterly defenceless as he was, he had not yielded at the first shot, nor the second, nor until he saw that the submarine had the speed of him. He stopped the engines. The

Downshire drifted on, losing speed, and lay rolling slightly, while the submarine, drawing up to within fifty yards of the port quarter, stopped also.

‘The *Downshire’s* firemen, who had been furiously heaving coal, momentarily expecting the next shot to crash into the engine-room and very likely cut the main steampipe, came on deck, black, sweating and sullen.

‘The German submarine officer, addressing the *Downshire* “in perfect English” from his conning-tower, courteously issued his orders. The crew of the *Downshire* were to take to their boats, and the master was to bring the ship’s papers to the submarine. (They could have given small satisfaction to the German, for the *Downshire’s* sole cargo was five tons of empty cement bags.)

‘Even at this period of the war British seamen knew enough of the German officer to know that his temper was about as calculable as the temper of a tiger. The crew of the *Downshire* launched their two

lifeboats, pulled towards the submarine, and stared, composed and curious, at the strange vessel and the foreign officer. That personage was decisive but urbane. He regretted the necessity of his action, which, he said, was due to the exigencies of war. One boat he ordered to pull to windward. The other boat, in which was the master, was ordered alongside the submarine. The master and the boat's crew were taken on board, where they scrutinised the white faces and the stiff, over-trained figures of the German blue-jackets. Then the submarine officer ordered the second officer and the steward of the *Downshire* back into their boat, telling them to get provisions for the *Downshire's* men. Five men of the submarine's crew pulled the boat to the *Downshire*, and while the second officer and the steward were fetching provisions from below and placing them in the boat, the Germans were occupied in fixing a bomb under the *Downshire*.

‘These proceedings were watched in an

absorbed silence by the master and the *Downshire's* men in the submarine, and by the men in the second lifeboat, standing off at a little distance. It was the execution of their ship they were contemplating. By this time it was evident that no harm to themselves was intended.

‘The first lifeboat, stocked with gear and provisions, returned to the submarine. The Germans went on board, the master and the rest of his men embarked again, shoved off, and pulled away to join the second lifeboat, while the submarine got under way, drew further from the ship, stopped again, and waited.

‘The men of the *Downshire* rowed away into the gathering darkness, and the submarine faded out of sight, and the form of the lonely ship grew blurred and dim. There was a flash of fire, the sound of a dull explosion rolled across the water, the distant ship plunged bows under and vanished.

‘It was then six o’clock. The whole episode had lasted half an hour. Within

the next half-hour the *Downshires* were picked up by two steam drifters.

‘The treatment by the German officer of the officers and men of the *Downshire* shines by contrast with the conduct of some of his colleagues. That circumstance does not alter the fact that, in destroying the ship and in setting her people adrift, he violated the law of the sea.’

‘It was tea-time on board the steamship *Harpalion* proceeding down the Channel, bound for the United States. The third officer went to the bridge, the master and the Trinity House pilot went down to the master’s cabin to tea. The second officer sat at tea with the engineers, and here follows his account of what happened.

“We had just sat down to tea at the engineers’ table, and the chief engineer was saying grace. He had just uttered the words ‘For what we are about to receive may the Lord make us truly thankful,’ when there came an awful crash. I never saw such a smash as it caused. Cups

and dishes were shattered to pieces, everything in the pantry was broken, and photographs screwed into the walls fell off."

'So the second officer told *The Times*, from whose issue of February 25th, 1915, the passage is quoted. Such was the event inside the ship. Now let us look at it from outside, from the bridge of a distant man-of-war. Her commanding officer, watching the *Harpalion* afar off, saw a column of water leap alongside her, then another, and heard the dull boom of an explosion, like the slamming of a heavy door in a vault, instantly followed by a second boom. He ordered full speed and steamed towards the *Harpalion*.

'On board her, master, pilot, officers and crew had all tumbled up on deck, where, in a fog of steam and smoke, they were just in time to receive the descending fountain of the second explosion. The ship listed to port and began to settle by the head; it was reported to the master that three firemen had been killed below; and he saw to seaward the periscope of

a submarine. He also beheld the comfortable spectacle of a King's ship tearing towards him with a bone in her mouth.

'The master ordered the boats to be got away. One was already in the water filled with men, by the time the man-of-war drew close alongside. Her commanding officer hailed the master, who instantly informed the naval officer of the presence of an enemy submarine. The naval officer assumed the conduct of affairs. He ordered the boat's crew then afloat to stand by to help save the rest of the crew ; and immediately started in pursuit of the submarine, cruising at high speed about the *Harpalion* while her people were getting into the boats. Failing to find the submarine, the man-of-war returned, embarked the master, the pilot, the rest of the officers and the crew, thirty-nine all told, and three dead men, and let the boats drift.

'The naval officer and the master then took counsel together. The master thought the ship was sinking. The naval officer

thought she was likely to keep afloat, but that, as the enemy submarine was probably hanging about, it would be unsafe to leave the crew in the *Harpalion*. It was therefore decided to land the crew. The naval officer signalled to the nearest naval station asking that a tug should be sent, and proposed that the *Harpalion* should be left anchored with lights burning, an arrangement which was not, in fact, carried into execution.

‘The man-of-war went on to the nearest naval station, and landed the living and the dead. She then reported events to her own naval station. The ship was torpedoed at a little after five o’clock in the afternoon of Wednesday, February 24th, 1915. By a quarter to six she was abandoned. For nearly twelve hours afterwards the *Harpalion* was lost. The naval officer was right; she was not sinking. If a tug was sent out that evening in response to the signal, she failed to find the *Harpalion*.

‘But let it not be supposed that the

Admiralty allows a ship to disappear without explanation. That evening and the next day, Thursday, the Admiralty was asking every naval station in the vicinity of the loss, "Where is *Harpalion*?" Station A reported trying to find *Harpalion*, incidentally reporting at the same time that three other vessels had been put down. Station B reported *Harpalion* derelict, anchored, lights burning, and later, "Cannot find, but searching." Station C replied, "Not in my district."

'Where was *Harpalion*? She was simply drifting about, masterless and miserable. She drifted from 5.45 P.M. on Wednesday to 4 P.M. on Thursday. Then she was sighted by the steamship *Ariel*, whose master promptly sent four men on board to investigate matters. It was clearly a salvage case; but in their deposition the four gallant seamen say simply, "We four men got on board as prize crew."

'To be precise, a prize crew is a crew placed by the captor on board a vessel

captured by an act of war. Salvage is another affair. Any ship succouring another vessel, derelict or wrecked, is entitled to claim reward from the owners. In the case of the *Ariel* and *Harpalion*, it would seem that the men of the *Ariel*, considering their help to be in the nature of war service rather than a commercial transaction, preferred to call themselves a prize crew. But this is conjecture, for the four deponents, appearing for a moment in the light of history, have gone again. They were the first officer of the *Ariel*, two able seamen and one apprentice.

‘They boarded the deserted *Harpalion* on Thursday afternoon, and their own ship, the *Ariel*, went on her way short-handed. What they did next is not revealed, except that they tried to take her to Cardiff. Their situation was dangerous enough. The ship was full of water forward, and listing to port. At any moment a questing submarine might have sent her to the bottom without warning. Presumably the prize crew tried to get steam on

her, but there is nothing to show that they were successful. If they failed, the ship was not under control. If they succeeded, their progress must have been very slow. In any case, there were only four men, instead of forty-one, to work a ship of 3669 tons register. The chief officer would be on the bridge, steering and conning the ship, one able seaman in the stokehold, one in the engine-room, leaving the apprentice for services as requisite, such as getting meals, carrying messages and doing odd jobs.

‘The full story of that night on board the *Harpalion* spent by the prize crew adrift in a ship which they believed to be sinking, remains to be told. Perhaps it will never be told, like many another deed of the sea.

‘Early on the Friday morning wind and sea began to rise. The *Harpalion* was then within about twenty miles of the spot upon which she had been torpedoed. The ship was heavily water-logged ; the water was washing in and out of her, and the

chief officer was unable to keep her head to the sea. They drifted helplessly before the gale in that dark and bitter February morning until eight o'clock, the hour at which all over the world the white ensign is hoisted on the quarterdeck of His Majesty's ships. And at that hour the men of the *Harpalion* descried three men-of-war surging towards them through the smothering sea. Two flew the tricolour and one the white ensign.

'The British torpedo-boat drew near and hove a line on board the *Harpalion*. The prize crew hauled it in, hauled in a grass rope, hauled in a hawser and made it fast, and the little torpedo-boat began to tow the dead weight of the big cargo-boat. The weather grew worse, and the torpedo-boat, unable to make any way, was obliged to cast off. "We still stuck to the *Harpalion*," the prize crew deposed. They stuck to her all that day, in wind and sea. A tug came, but so heavy was the weather she could not get the *Harpalion* in tow, and so stood by her. Night

came, and still the prize crew stuck to their prize. Towards midnight the ship was settling dangerously, and the prize crew were forced to conclude that they could do no more. At half-past eleven on that Friday night they went over the side into their boat, left the *Harpalion* and went on board the tug. They were not much too soon. Thirty-five minutes afterwards the *Harpalion* went down.

‘The tug landed the prize crew at Havre, where, before the Vice-Consul, they made a deposition of the shortest recording their adventure, and so went their ways.

‘All that Friday the unseen eye of the Admiralty had been bent upon the *Harpalion*. Naval station D having reported, “Cannot find *Harpalion*,” naval station B reported “*Harpalion* picked up by *Ariel*,” and later “Abandoned by *Ariel*.” Naval station A reported “*Harpalion* being towed.”

‘Finally, on Saturday, Lloyd’s reported “*Harpalion* sunk.” But she had floated for fifty-five hours after having been torpe-

doed. So the naval officer was right in his estimate. Of that period, she was twenty-three hours derelict, thirty-one and a half hours in charge of the prize crew, and a final half-hour again derelict in the storm.'

Such losses as these were being inflicted while Burney was toiling day and night to produce the Paravane. During this period, the losses among the British steamships of 1600 tons gross and upwards were as follows :—

In September, 1914, 23 vessels ; in October, 16 ; in November, 4 ; in December, 4 ; in January 1915, 7 ; in February, when the German blockade was proclaimed, 8 ; then, in March, a swift rise to 18 ; a drop in April to 6, much to the public relief ; a rise again in May to 13 : in all, 99 ships, not including sailing ships and small craft.

The theory that these losses were not worth serious consideration, was still maintained. The Admiralty had organ-

ised a great fleet of patrols, mine-sweepers and small craft, and continued to increase it. But there was no effective weapon either for destroying submarines, or for protecting ships under way against mines. Admiral of the Fleet Lord Jellicoe described in his book how the Grand Fleet was constantly hunted by submarines; how destroyers were perpetually being despatched at full speed to the place where a submarine had been sighted; how, not unnaturally, they failed to find it; and how the movements of the Fleet were circumscribed by minefields.

In June 1915, the Admiralty approved of the ordering of a number of sets of Burney's new gear, and of the use of a destroyer for experimental purposes. At the same time Lieutenant Burney was appointed to H.M.S. *Vernon* to supervise the construction and the issue of the new gear.

At this point it will be convenient to describe the Paravane itself. As yet it had no name; not until the 3rd December

1915, when Commander E. L. W. conceived the name, was the gear christened nor was it until the following January that the name received official approval. From the first it was, of course, kept secret, so far as possible; indeed, the initials P. V. were commonly used; few of the public ever heard either of P. V. or of Paravane, and fewer knew what it was. The secrecy maintained was remarkable. But the name is no longer a secret, and may here be employed without indiscretion.



GENERAL ARRANGEMENT OF HIGH SPEED SUBMARINE SWEEP, SHOWING AN EXPLOSIVE
PARAVANE ENGAGING SUBMARINE

By kind permission of Messrs. Vickers, Ltd.

VI

THE Paravane is essentially an aeroplane. It consists of a buoyant torpedo-shaped body, across the nose of which is fitted a plane. It is so constructed that, when it is towed from a ship, it may be set to a certain depth below the surface, where it remains at a distance from the ship's side, so long as the ship is under way, and whatever may be the course and speed of the ship. The Paravane was at first designed to attack and to destroy submarines. It therefore contained an explosive charge, which could be fired either by impact or by other methods. The whole set of gear employing this form of Paravane is known as the High Speed Submarine Sweep.

Two Paravanes are towed from the stern of a destroyer or other vessel, one on either quarter, attached to winches

by specially designed towing wires. When the towing wire fouls a submerged submarine it slips along the surface of the submarine until it brings the Paravane into contact with the submarine, when the explosive charge contained in the Paravane is fired automatically. Such is the general outline of the Paravane, the details of whose construction are secret.

The second form of Paravane was designed for cutting the mooring wires of mines, thus enabling a ship to pass safely through a minefield. The shape of the mine-cutting, or protector Paravane, is the same, but it contains no explosive charge, and the head is fitted with steel-toothed jaws, making the cutter which severs the mooring wire of a mine. A protector Paravane is towed one on either side of a ship, either man-of-war or merchant vessel, the towing wire being attached to the bows at the level of the keel. The Paravane is set at a depth several feet below the level of the keel, and, like the High Speed Submarine Sweep, tows out at



GENERAL ARRANGEMENT OF PROTECTOR PARAVANE.

By kind permission of Messrs. Vickers, Ltd.

a distance from the side of the ship. Thus the towing wires make a wedge shape, the apex being at the bow of the ship. Within the limits of the wedge, the towing wire catches the mooring wire of a mine, the mine is deflected away from the ship, and the mooring wire slides into the jaws of the cutter, by which it is severed. Then the mine comes to the surface. Thus the only point of the vessel unprotected is the bow itself, but in practice the chance of the bow of a vessel striking directly upon a mine is negligible. As to the mines set adrift on the surface, they can be exploded by fire, or otherwise destroyed. Should a drifting mine lie in the path of a vessel, the bow-wave usually washes the drifting mine outwards from the side.

The towing wire of a Paravane takes a definite curve, which is shown in the illustrations. It is this catenary-like curve, the result of the inter-action of the various intricate stresses involved, which limits the length of the towing wire. A spread of about 110 feet on either

side of the vessel, or of about 220 feet in all, can be obtained. The protector Paravane thus sweeps a broad path, cutting loose any moored mine within that path. If the mine be moored so deep that the Paravane wire passes over it, the ship also will pass over it, except in a very rough sea, when the ship is pitching heavily, in which case the Paravane wire ceases to be an absolute protection.

The necessity of towing the protector Paravane from the lowest point of the bows, which occurs at the intersection of the vertical line of the stem and the horizontal line of the keel, made it necessary to make a special fitting for that point, which is riveted to the bow and to which the towing wires are attached. By means of an arrangement of double chains running up and down on either side of the bow, the towing wires are lowered to this point when the Paravanes are hoisted overboard, and are hauled up to the forecastle deck when the Paravanes are taken inboard. The Paravanes them-

selves are hoisted out by means of davits and derricks fitted on deck. This brief general description may serve to indicate something of the nature and the complexity of the gear required, and that a certain amount of training is required to enable officers and men to use it.

As the designs of both men-of-war and of merchant ships vary, it was necessary to design various types of Paravane, various sizes of wire, and various modifications of gear to fit the ships. Ships under construction could be adapted to the gear; but the gear must be adapted to existing ships.

Another application of the Paravane, the High Speed Mine Sweep, is worked on the principle of the High Speed Submarine Sweep. The Paravane, instead of containing an explosive charge, is fitted with cutters, and is towed from either quarter of a destroyer. In this case the wedge made by the towing wires spreads upon a much wider path than the wedge of the protector Paravane. The two Para-

vane wires pass through blocks attached to either end of a short span of wire. From the centre of the short span of wire is towed a depressor Paravane, called by reason of its shape a tadpole, the span of wire and the tadpole being secured to the ship by a separate wire. The use of the tadpole is to keep the two Paravane wires down to a depth as near as possible to the depth of the Paravanes themselves, thus preventing a mine from passing uncaught between the Paravanes. Paravane and tadpole wires make a complete crinoline.

The High Speed Mine Sweep does not affect the manœuvring powers of the ship ; it can be used at a much higher speed than any other form of sweep, cutting up a minefield and bringing the mines to the surface, where they can be destroyed. In a double ship sweep of the old type, the mines are collected in the bight of the wire and are towed along.

The gear required for the High Speed Mine Sweep includes two rotary dropping davits, two steam winches, and various



GENERAL ARRANGEMENT OF HIGH SPEED MINE SWEEP, SHOWING PARAVANE
TOWING FROM STERN OF DESTROYER

By kind permission of Messrs. Vickers, Ltd.

accessories fitted on the deck of the destroyer.

The Paravane fitted to merchant vessels was called the Otter, for convenience in distinction.

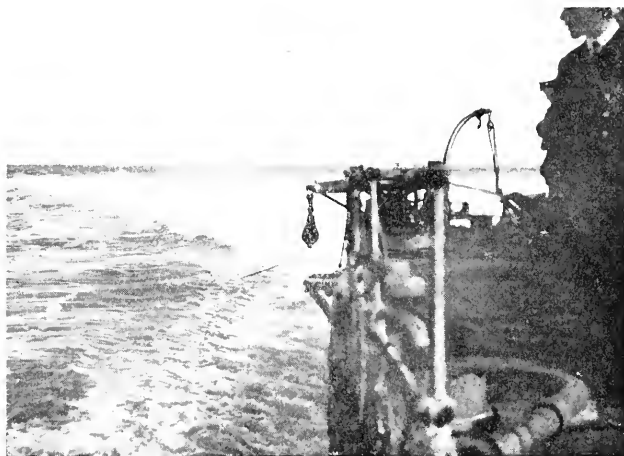
The Paravane looks like a model of an antediluvian fish, with its corpulent body, six to twelve feet long, its plane fitted across its formidable snout, which is armed with steel teeth, like the jaws of a shark, and its stiff tail-fins. Or it looks as if a torpedo had been trying to fly.

This grotesque and amazing creature, half-fish, half-bird, gropes for the submarine in the still deeps of the sea, clings to it and blows it and itself to atoms. Or, swimming steadily speed for speed with its ship, it bites through the wires of a minefield, and the ship goes free.

VII

WHEN, in June 1915, the Admiralty sanctioned the ordering of a certain number of sets of the explosive Paravane gear, it became evident that the business of manufacturing the Paravane and accessory gear, which, if it was required at all was required immediately, must be extended from the Government yards to private firms. H.M.S. *Vernon*, Torpedo School, was therefore authorised by the Admiralty to deal directly with private firms in respect of design. But any modification of design, such as experiment constantly suggested, and all financial arrangements were still to be submitted to the Admiralty and were subject to the customary departmental procedure.

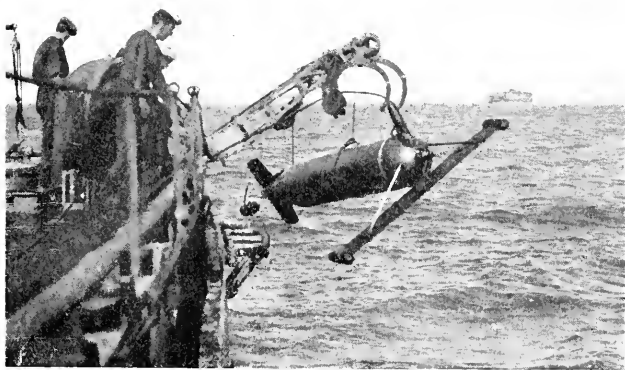
(To those unfamiliar with these matters, it should here be explained that according to Service regulations for all transactions



STERN OF A DESTROYER UNDER WAY

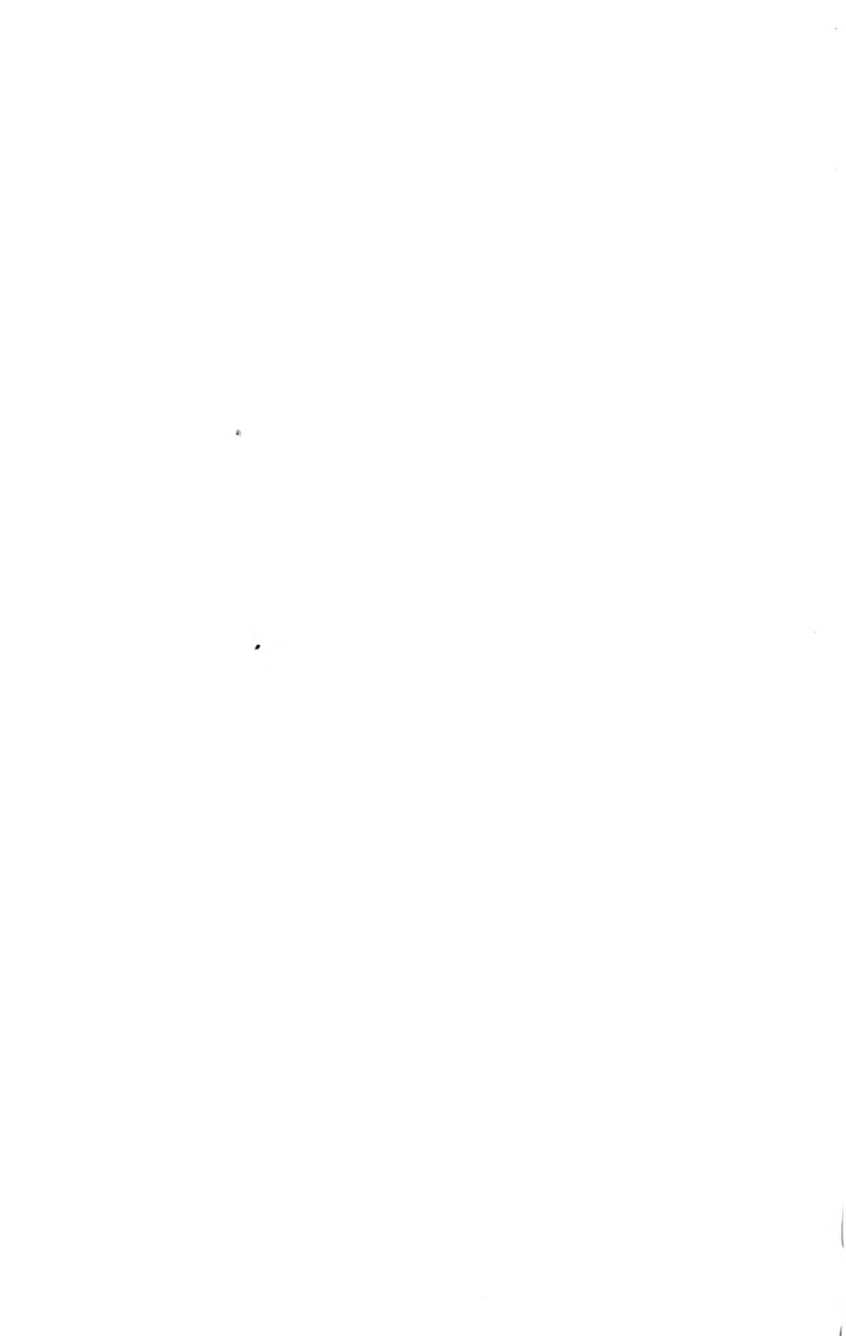
Showing the towing-wire (electric) of the High Speed Submarine Sweep standing out from the fore-and-aft line of the ship as the Paravane tows. Looking aft over the Destroyer's starboard quarter.

Photo, Commander C. S. Bowles



HIGH SPEED SUBMARINE SWEEP PARAVANE BEING HOISTED IN TO THE DROPPING-GEAR AFTER A RUN AT SPITHEAD IN A DESTROYER

Photo, Commander G. S. Bowles



in H.M. ships the captain is responsible ; so that while Lieutenant Burney was on the staff of H.M.S. *Vernon*, all his business was officially described as *Vernon's* business.)

If Burney was immersed in work before, he was now plunged neck-deep into a task big enough to occupy a whole Government department. There were experimental trials to be conducted at sea, improvements in design to devise, drawings to be made, specifications to be written, business with private firms to be transacted, official reports to be written, and his inventions to be patented. He had, in fact, to start and to conduct a vast technical and industrial enterprise, which was eventually to cost millions, in a cabin in the *Vernon*, destitute of modern business appliances, and with such scant clerical assistance as the *Vernon* could provide. Moreover, the urgency of the affair, at least in Burney's view, was extreme, for he had long foreseen what might be the effect of the steadily increasing submarine

destruction of commerce, and he knew, of course, what the whole Navy knew, but of which the public were ignorant, the limitations imposed upon the action of the Fleet by the enemy's minefields.

It was at this critical moment, when Burney was fighting with his back to the wall, that the Admiralty began to give him some reinforcement. The number of officers needed in every branch of the Service was insufficient, but it was fortunately possible to appoint Commander E. L. W. to take over the duties of First Lieutenant of *Vernon*, a post he had occupied before the war. In 1914, Commander, then Lieutenant-Commander, W. was appointed First Lieutenant of H.M.S. *Kent*, Captain John D. Allen. Lieutenant-Commander W. was present at the battle of the Falkland Islands, of 8th December 1914, in which the *Kent* did notable service, taking part in the chase and sinking of the light cruiser *Nurnberg*, and subsequently, with H.M.S. *Glasgow*, hunting for four months the light cruiser

Dresden, which was finally sunk on 14th March 1915, off Juan Fernandez, the Germans escaping to Robinson Crusoe's island in their birthday suits.

In January, Lieutenant-Commander W. was promoted to the rank of Commander, and was re-appointed to the staff of *Vernon*. As Commander W. was then in the Pacific, six months elapsed ere the officer who was to relieve him could arrive, so that it was not till July that W. rejoined H.M.S. *Vernon*, Captain F. L. Field.

In the Pacific, W. had sailed and fought in the fashion of the Old Navy, untroubled by submarines, chasing and cruising in uncharted waters, and conducting cutting-out expeditions in the solitary, ice-walled antres of Magellan's Strait. He returned to the *Vernon* to deal directly with the New Navy of destructive inventions, of which he had had a foretaste, for upon the day before he left *Vernon*, Lieutenant Burney had shown to him the Burney scheme for dealing with submarines. But Com-

mander W., rejoining *Vernon*, little knew what lay ahead of him. He was instructed to fulfil the duties of First Lieutenant, which involved the supervision of experimental work, and a member of that section was Lieutenant C. Dennis Burney. It speedily became evident to W. that his whole time and his utmost energy would be required to deal with Burney's affairs; and he obtained permission from Captain Field to be relieved from all other duties.

In the same month, July 1915, a brilliant young officer, Lieutenant G. C. B., completing his torpedo course in *Vernon*, came out first amongst the officers taking the long course qualifying for torpedo officers; and at Commander W.'s suggestion Lieutenant B. was appointed to W.'s department. Lieutenant B. assisted Burney in fitting and testing the new gear in the destroyer supplied by the Admiralty for the purpose, and eventually he took over the whole of that part of the work.

Such were the beginnings of what was

to develop into a complete department. Throughout that development, Burney was the defiant irresistible force, W. the patient, tactful and sagacious smoother of difficulties. If Burney tore up the road in his progress, W., following, made the rough places plain. Burney had but one idea : to achieve his end ; W.'s business was to make it possible. And he did.

A little later, in the early autumn, Commander W. was joined by Lieutenant George S. Bowles. Mr. Bowles, an ex-naval officer, had rejoined the Service at the declaration of war with the rank of lieutenant. Being an ex-naval officer, sometime a member of Parliament, and being by profession a barrister, the Admiralty considered that an appropriate sphere for him would be mine-sweeping. Burney, meeting Mr. Bowles at dinner, judged his man, asked him to join the Burney enterprise, walked into the Admiralty, and obtained their Lordships' approval of the appointment of Lieutenant G. S. Bowles to *H.M.S. Vernon*. Lieu-

tenant Bowles may perhaps be described without irreverence as the diplomatist of the party. Together with a legal (and a naval) training, he owned a knowledge of men and of affairs rarely possessed by a naval officer, and a literary accomplishment of a high order. As Mr. Bowles has now left the Service, it will not injure his career to observe that he is gifted with a cheerful independence of mind and a genial scorn of convention, as such, which were of quite inestimable value in the achievement of the work to which he gave himself. To Lieutenant (now Commander) Bowles fell the framing of the innumerable official reports required, the writing of much correspondence and the conduct of many delicate interviews.

At this time, the Paravane department (though it had as yet no official name) was concentrated in the cabin of the First Lieutenant in the *Vernon*. In that narrow chamber lived and worked Commander W., Lieutenant Burney and Lieutenant Bowles, Lieutenant B. when he was not at

sea conducting experimental work, one warrant officer, two petty officers, two men and one shorthand writer. The warrant officer had been Burney's gunner in *Velox*, and he was therefore acquainted with the experimental side of the work. One of the petty officers was a torpedo-gunner's mate of *Vernon*, the other was the petty officer in charge of the motor-boat in which the Paravane officers went to and from the shore.

In that stifling cabin (called the Oven), then, W. and Bowles wrote and directed affairs, Burney dictated letters to the shorthand writer, typewriters were clattering, and some one was continually bellowing into a long-distance telephone.

As the volume of business to be transacted swiftly enlarged, it became necessary to discover some one who could take charge of the financial side of the dealings with private firms, which were now manufacturing the new gear in large quantities. He must be a man of position, owning a professional knowledge of commerce and

knowing something of engineering. Clearly not a person easily found, in the circumstances of the time, when men of military age were serving and men over military age were wholly occupied with Government work. The Paravane party were at a stand, when Lieutenant B. suddenly announced that 'he had an uncle.' Whereupon he was told to produce his uncle, instantly.

And presently appeared Mr. William H. McConnell, who was a director of coal and iron companies. Mr. McConnell's two sons were serving in the Army; he himself had done Government work in connection with the hydrophone, and had returned to civil life. With an admirable public spirit, Mr. McConnell agreed to join the Paravane department, and he was accordingly appointed to *Vernon*, with the rank of Lieutenant, Royal Naval Volunteer Reserve.

At this time, Burney was so largely occupied with organisation, that he required an assistant in his technical and

experimental work ; and on a day, there came to *Vernon* Lieutenant V. H. D., to pay a polite call upon his old shipmates. Lieutenant D. had passed through H.M.S. *Excellent* with Burney ; he had been for a year with E. L. W. in H.M.S. *Kent*, whose gunnery officer he was, and had fought her through the Falkland Islands engagement. Lieutenant D. was known to be an exceedingly capable naval officer and a brilliant mathematician. When he came to visit *Vernon*, he was on sick leave ; and he was persuaded to apply to join the Paravane department. Being unfit for sea service, Lieutenant D. succeeded in obtaining his appointment to *Vernon* ‘for gunnery duties’ (of which there was none) and so became Burney’s assistant on the theoretical side.

Thus by good fortune, or the hand of destiny, was assembled the group of officers, which, gradually adding to its number, presently achieved so great an enterprise. Their very existence was utterly unknown to the public. Officially, they were re-

garded merely as a department of H.M.S. *Vernon*, the experimental school of the Navy. *Vernon* herself, the home of science in the Navy, was (and is) an old wooden line-of-battle ship roofed in atop. There she lay, islanded high up the stream in Portsmouth Harbour, a black and venerable monument to the official idea of the place of science in naval warfare.

VIII

DURING the summer and autumn of 1915, the Paravane department in *Vernon* were intensely at work providing the experimental sets of gear and the sets of gear to be fitted to H.M. ships at sea. By October, according to the available evidence, several enemy submarines had been sunk or damaged by Paravanes. Experimental work was carried on continuously in *Vernon*, while the actual manufacture of the gear by private firms was proceeding and the gear was being fitted to ships in the Fleet for submarine destruction.

The destruction of submarines was the original purpose of the Paravane; but the mine was nearly as formidable a weapon as the submarine, and early in 1915 Burney perceived that the Paravane could be employed both for mine and submarine destruction; and, as the submarine was

used to lay mines, to destroy mines would be partially to defeat the submarine. Burney therefore framed a report in which he explained that ships fitted with the Paravane could be effectively protected against moored mines. Burney was, however, directed to confine his investigations to the anti-submarine Paravane for the time being. His report dealing with the anti-mine variation was forwarded by the Commander-in-Chief of Portsmouth to the Admiralty, and nothing more was heard of it.

As already described, from September 1914, and including May 1915, 99 British merchant ships of 1600 tons gross and upwards had been lost, not including sailing ships and small craft. In June 1915, the losses were 18 vessels; in July, 13; in August, 33; in September, 19; in October, 15; or 98 ships in five months, besides a number of neutral vessels. These losses were still considered to be negligible.

In October 1915, the anti-submarine Paravane being in working order, and its

manufacture progressing, Burney again discussed the anti-mine application of the Paravane with the Captain of *Vernon*, who thereupon sent Burney to consult with the Chief of Staff of the Grand Fleet. Burney informed the Chief of Staff that if the necessary provision could be made to shorten the customary official routine in making arrangements for manufacture with private firms, and if a sufficient staff of designers and draughtsmen was furnished, it would be possible quickly to supply the Paravane mine-protection gear. The fulfilment of these two conditions, simple as it may appear, presented obstacles so formidable that only the Commander-in-Chief could hope to surmount them. And accordingly the Commander-in-Chief of the Grand Fleet straightway requested the Admiralty to instruct the Captain of *Vernon* to enable Burney to conduct experiments with the anti-mine Paravane.

Burney at once returned to Portsmouth ; in a few days the new anti-mine Paravane

was fitted to the experimental destroyer, H.M.S. *Melampus* ; and on 4th November, at Spithead, moored mines were cut for the first time by the Paravane. Burney had succeeded in devising a weapon which made the mine innocuous and which would restore to the Fleet its freedom of movement. All that now remained was to manufacture enough Paravanes to fit all vessels, both men-of-war and merchant ships.

At the same time it was necessary to continue the manufacture of the anti-submarine Paravane. It was clear that the exigencies of war demanded that the work should be begun and completed with the utmost speed. It was also clear that *no organisation existed for the purpose.*

In order to appreciate the extraordinary difficulty of the position, it is necessary to understand the elements of official procedure.

IX

THE principle upon which Admiralty procedure is based, is the theory that all initiative proceeds from the top downwards through the official departmental machine. One of the Sea Lords (let us say) gives an order, or issues instructions that (for instance) a new gun mounting is to be made and supplied. The requisite instruction goes from department to department, and is eventually carried into execution. Perfect.

But now let us suppose that there is initiative at the bottom instead of the top. The proposal must be forced backwards and upwards to the top against the revolutions of the machine. Say that the proposal is made by a member of the staff of the *Vernon*. It is forwarded in writing by the Captain to the Secretary of the Admiralty. That official marks the docu-

ment for their consideration to the various departments concerned : three, four, seven, eight departments, more or less. The paper is officially known as a Docket. It is placed in an official cover designed for the purpose, and on that cover are written the various names of the departments to which it must go, in turn. Be it observed that there is only *one* original paper. It is not duplicated. If it were duplicated, a copy could be sent to each department, so that all should receive it at the same time. But that is not done.

The Admiralty is the size of a town. Its population, male and female, dwelling in gloomy chambers, great and small, ranges in condition from My Lords, inhabiting an upper wing whose corridors are paved with indiarubber, lest the slightest sound should interrupt their meditations, to the messenger-boys fidgeting in the entrance hall, surveyed by the melancholy single eye of the statue of the late Lord Nelson. In a back room of every department live the Admiralty mes-

sengers, trusty old veterans in uniform, perpetually making tea on a sea-coal fire. The Admiralty messengers are charged with the duty of keeping thousands of Dockets steadily circulating through Admiralty Town. Many leagues of lightless corridors do they traverse daily. Every official in every department has on his massive table a long tray, or trough, divided by partitions into compartments, each of which is duly lettered, and each of which holds a pile of Dockets. These are brought by messengers and taken away by messengers. The official struggles breast-high through a jungle of Dockets all day and most of the night, and ever the messenger brings more Dockets. The only sign in the Admiralty that the Armistice had been signed was that in some rooms the tray, or trough, was empty.

Let it be remembered that the administration of the Fleet is but a small part of the duties of the Admiralty. My Lords administer docks, naval stations, and establishments in every quarter of the

globe. They conduct vast manufacturing concerns in the dockyards. They deal in huge commercial transactions with private contractors. They spend in peace time some fifty millions sterling of public money, every penny of which must be accounted for. They own enormous quantities of stores, every item of which is tabulated. If a Royal Marine loses the pull-through of his rifle, value three-halfpence, the Admiralty will spend three-and-sevenpence in discovering how he lost it, and why. If an officer spends two-and-ninepence on Service, his account is challenged by officials who are paid salaries to tell the officer he ought not to have spent more than two-and-sixpence. The point is to have the thing right.

So, if a Docket contains a proposal of the utmost military urgency, is it to be supposed that a little thing like a war shakes the Admiralty? As well might the Pyramids tremble in a sandstorm. And so, when the Secretary of the Admiralty marks (say) a *Vernon* Docket to the

three, four, seven, eight departments concerned, it goes to each of those departments in turn with the passionless infallibility of a law of nature.

But it does not go directly to the official who deals with it. Oh, no. There is a much better system than that. It goes to the departmental registry, and from there it goes to the right official. He may be a Torpedo authority. He considers the Docket and writes on it his opinion. The messenger presently enters and carries away the Docket to, let us say, the Mining department registry, whence it goes to the right Mining authority. Thence, perhaps, by the same process, to the Electrical people. And so on. In each stage, the Docket is enriched by an opinion, a suggestion, a remark, a query. Eventually, now much swollen in bulk with these accretions of wisdom, the Docket comes to port in the tray of the Sea Lord who commands all the aforesaid departments. Two or three weeks or more have now elapsed. But we have made a beginning. The point is to

have the thing right; and so far, it is right.

Now it is the duty of the Sea Lord to make a decision. He makes it on the accumulated evidence before him. If he decides the original proposal to be what is officially called inadvisable, there is an end. The Docket is removed to the archives and is there interred with an epitaph.

But if the Sea Lord approves the proposal or project, what then? So far as the Sea Lord is concerned, the thing is simple. The Secretary of the Admiralty is instructed to take the necessary steps (official phrase) to carry the proposal into execution. So, in the case under consideration, the Secretary causes to be written a letter to Captain of *Vernon*. That officer instructs the officers of the department in question.

If, now, the proposal is that Paravane gear should be made and fitted, it is necessary (1) to make the design, (2) to make the drawings, (3) to write the specification. It is now perhaps five or six

weeks since the proposal was submitted, and so far nothing, that is to say nothing practical, has been done. However, that is the result of the system, which can no more be altered than the solar system.

Design, drawings, and specification are now submitted to the Admiralty for approval. They go through exactly the same departmental process as the original Docket underwent, finally fetching up on the table of the same Sea Lord, after another two or three weeks or more. The Sea Lord approves them. Still, nothing practical has been done. But it is just going to be done.

The drawings and specification now travel to the Contracts department, whose business it is to make contracts with private firms. The firms on the Admiralty list then receive copies of the drawings and specification, and they are asked to submit their prices for making the article therein described. The private firms, in time of war, have a deal of work, and they may take a month or more framing their

estimate. They then send their tenders to the Admiralty, and upon a day appointed the Contracts department solemnly opens the sealed envelopes, compares the prices one with another and, according to rule, accepts the lowest tender.

A period of three to five months, probably six or seven months, has now elapsed. But now the contractor is ordered to proceed with the actual manufacture. If it is a strange and complicated engine such as the Paravane, the manufacturer must obtain special plant and make special tools. That process will occupy at least another month. Then, and not till then, will the manufacture begin.

It should here be observed that if the designer should desire to alter his design in accordance with the requirements discovered by further experiment, he must start the whole business again from the very beginning: proposal, design, drawing, specification, contract. So that *either*

there is no improvement, *or* another eight or nine months are expended in making that improvement.

In the case of the Paravane, it was wanted so much sooner than immediately, that words could not describe its urgency. The Grand Fleet wanted mine protection ; every merchant vessel in the world also wanted mine protection ; the submarine hunters wanted the High Speed Sweep ; and the Germans were sinking a ship nearly every day.

X

It was evident that the Admiralty system, how excellent soever, could not possibly fulfil the conditions demanded in the production of the Paravane. In these circumstances, Burney had represented to the Chief of Staff of the Grand Fleet the necessity for a new procedure and a technical staff. The intervention of the Commander-in-Chief of the Grand Fleet had then enabled Burney in *Vernon* rapidly to construct the experimental anti-mine Paravane. The Admiralty also permitted *Vernon* to deal directly with private firms in respect of any small quantities of gear required for experimental purposes. But all drawings must still be made in Portsmouth Dockyard by draughtsmen already occupied with other work, and all large quantities of gear must be ordered through

the Dockyard authorities and through the Admiralty.

In December 1915, experience of these methods showed that if some ten months were required in which to produce the Paravane, five of these months were expended in correspondence and procedure. The Paravane officers in *Vernon* proposed a new system, which was submitted to the Admiralty, but upon whose adoption the Admiralty came to no decision. In January 1916, the Paravane officers were still working in the Oven in *Vernon*; were still unable to obtain their own staff of draughtsmen; and were still obliged to order gear through the Dockyard and the Admiralty.

In the meantime, how went the war? By December, when the Allies were compelled to withdraw from Gallipoli, they had lost seven battleships by mine and submarine in that disastrous campaign.

In October 1915, 15 merchant steamships were put down; in November, 23;

in December, 16. The total losses among British ocean-going steamships of 1600 tons gross and upwards for the year 1915 were 189. These losses were still considered by the authorities to be negligible. Writers on the subject compared them with the losses inflicted upon merchant shipping during the Napoleonic wars, showing that the percentage of loss was then greater. As every one knew that England won the old French war at sea, in spite of losses, the conclusion was satisfactory. That the Admiralty had taken over a large number of merchant ships, so that they were no longer available for the carrying trade; that German merchant ships were kept in port; that, with a greatly reduced service, the demand upon that service had doubled; that neutral as well as Allied ships were being put down: these things were tactfully waved aside as better forgotten. There was a pleasant impression that it was unpatriotic to think about them. There was a less pleasant feeling, also, that if

you thought about them too carefully, you would lose your appetite.

The Annual Report, 1919, of the Liverpool Steam Ship Owners' Association contains the following instructive remarks upon the conditions of the time.

‘As the war demands increased, until nearly one-fourth of our total ship carrying power had to be given up to the fighting services, it became impossible even for the British Mercantile Marine, which had been built to carry one-half of the oversea trade of the world, to go on importing into the country the same quantities of both necessities and luxuries as had been brought in under conditions of peace. As prices advanced, forced up by competition between consumers all over the world, and as ship carrying power became impossible to procure, whatever freights were offered, the Nation became distrustful of its traders and shipowners and for a time concentrated its attention on keeping down prices and guarding against “pro-

fitting " while ignoring the real difficulty, which was the securing of its oversea supplies. But when it came to the suggestion of remedies, it was apparent that the Nation, which had for generations trusted absolutely to individual enterprise to satisfy its needs, was profoundly ignorant of the manner in which our oversea supplies were purchased, carried, stored and distributed. When war came, the Admiralty and War Office knew little or nothing of the vessels forming the Mercantile Marine, and of the manner in which they were employed. There were from 18,000 to 20,000 vessels on the British Register, and it was apparently assumed that therefore the supply of merchant ships for war purposes was practically inexhaustible. The real facts in regard to the limited number of vessels available for the ocean trades, and the average number of the voyages that could be made by those vessels in the course of the year, had been placed in detail by the Secretary of the Association before the Committee on Im-

perial Defence in 1913, and the War Risk Insurance scheme had been framed on the information so given. From the day upon which war was declared the working of the Insurance scheme verified, day by day, the accuracy of that information, but the fact that we had only about 3600 British ocean-going steamships at our disposal and that the withdrawal for war services of every 30 of these vessels involved of necessity a decrease of 1 per cent. in the volume of our oversea supplies, was apparently only recognised after two years of effort on the part of the Association. The weekly returns published by the Admiralty, in which were recorded the total number of entrances and clearances at all our ports, were accurate as figures, but entirely misleading, as they enormously magnified the apparent number of the ships to be protected on the ocean routes. They showed the repeated entrances and clearances on every Coasting and Home Trade voyage. The total figures were in thousands, whilst the ocean oversea voyages

could be reckoned in tens. It was this failure to understand the conditions under which our ocean oversea supplies were obtained, and therefore the limited number of voyages for which convoy protection had to be provided, that contributed in no small measure to the initial difficulty in protecting those supplies against the unrestricted submarine campaign.

‘Upon another point there was complete want of appreciation by the Nation, and that was as to the part played by foreign tonnage in bringing in our oversea supplies. Under peace conditions about one-third of our total oversea supplies were brought to this country in foreign ships. The carrying of the other two-thirds found employment for about only 60 per cent. of the British ships, and therefore, we had sufficient of our own tonnage to satisfy the whole of our needs ; but ocean tonnage commands its price all over the world, and as the total available supply diminished, we could not both call in the British tonnage from other trades and continue to

retain the services of the foreign tonnage on the old terms. The foreign freight markets bid to replace the want created by every withdrawal of British tonnage, and the foreign tonnage we had been using responded to these bids. The State could replace foreign with British tonnage, but unless we were ready to pay the best rates anywhere obtainable, we could not retain the carrying power of the foreign ships. These facts the Association brought before the Government, and during 1915 and 1916 it co-operated with the Government, through the Ship Licensing Committee, in bringing the maximum number of British ships into the United Kingdom trade with the least possible loss of the carrying power of the foreign vessels. To obtain reasonable protection for the trading ships on their voyages was one of the most difficult problems in which the Association has been privileged to assist. On the declaration of war the Navy was fully occupied in holding the Battle Fleet of the enemy, and the shipowners and the

merchant seamen recognised that they had to take their chances of capture and the destruction of their ships. But when the submarine campaign was opened in February 1915, and when the enemy took to organised piracy and murder, protection for the individual trading ships became an absolute necessity. The first effort of the Association was to press for the arming of the merchant ships for self-defence. This took time, and the work was delayed by the demands made by the country for guns for protection against air raids. Concurrently with the arming for self-defence, the Association pressed for an immediate increase in the protective force. No information has yet been published as to what vessels have been built by the Admiralty during the war, but it is the fact that when the unrestricted submarine campaign was opened in February 1917, the necessary force of fast, light ships was still not in existence, although the Admiralty had had at its disposal the shipbuilding facilities of

the country since the day war was declared.'

The progress of the war at sea waged under the conditions so lucidly indicated by the Liverpool Steam Ship Owners, may be again illustrated by another instance quoted from *The Merchant Seaman in War*. By this time, some merchant vessels were equipped with guns. The affairs to be narrated were not unusual events. The same sort of thing happened almost daily.

'The master of the steamship *Headlands*, which was entering the western approaches of the Channel, descried a burning ship. She lay about five miles distant to the eastward, and a thick smoke ascended from the forward part of her. The master, obeying the custom of the sea, despite of peril of mine and submarine, altered course to go to the assistance of the ship overtaken by disaster.

'It was then nine o'clock of a fine clear day, Friday, March 12th, 1915. Ere

twenty minutes had gone by, the master saw the conning-tower and masts of a submarine, which was then some three miles away, and which was heading south, towards the *Headlands*. And then he saw, further away, a little patrol boat heading for the submarine, saw the flash of guns, and heard the distant clap of their explosion, as the patrol boat fired at long range on the submarine.

‘The master immediately perceived several things at once. He perceived that in all probability the burning vessel had been set on fire by the submarine; that the patrol boat was attending to the submarine, and that the *Headlands* had run into an affair from which the sooner she departed the better. So the master put his helm hard-a-starboard and steered for the majestic lighthouse which towers, a white policeman with a lantern, at the sea-turning to the port.

‘The *Headlands* was shoving along as fast as she could go, when the master saw that the submarine was slashing along on

the surface so fast that the patrol boat was being left far astern, and also that the submarine was catching up the *Headlands*. The master, like other masters since, had occasion to reflect what happens when you leave your course to help a friend in trouble. Also he had time to frame his plan of action.

‘He decided to run for it, to hold on, and to force the submarine to expend a torpedo before he surrendered. It might miss him. If it hit, that could not be helped. He wished the ship’s bottom had been clean, when he could have got another two knots out of her. The submarine continued to gain on the *Headlands*.

‘The master went below, unlocked all his confidential papers, and burned them in the cabin stove, took his hand camera, and returned to the bridge.

‘The chase had begun at about twenty minutes to ten, and after about half an hour the submarine was within speaking distance astern, and her commanding officer was hailing the *Headlands* to stop.

The master made no reply. He read the number of the submarine—"U 29"—and then he knew he was being chased by the notorious Captain Otto Weddingen, who (it was believed) had sunk the armoured cruisers *Aboukir*, *Cressy* and *Hogue*. The master took a photograph of U 29, which vessel, he afterwards reported, was "of the latest type."

' Captain Otto Weddingen told the master that he would sink him in five minutes. The master, still disdaining to reply, ordered the crew to get their gear together, and held on his course.

' At 10.25 the submarine fired a torpedo. It struck the *Headlands* abaft the engine-room, and she began to settle down. The submarine instantly went about and made off at full speed. The people of the *Headlands* took to their boats, whence they perceived, far away, patrol vessels which were apparently hunting the U 29. Half an hour later the boats were taken in tow by patrols, which landed them in port at two o'clock that afternoon.

‘ In the meantime the submarine had sped over twenty miles to the westward and had sunk another ship. The vessel to whose assistance the master of the *Headlands* had been going was still burning. She was the *Indian City*, and she sank during the afternoon of the next day. The *Headlands* was still settling down. A steamer from the port went out to her, and had towed her to within a mile of the lighthouse she had failed to reach when, at eight o’clock in the evening, down she went.

‘ Here is the master’s (unofficial) comment, which I am permitted to quote :

“ I am naturally sorry that the old *Headlands* has gone, the more so as I have lost something like £150 in stores and personal effects. Still, I have the satisfaction of knowing that to the last minute we did all possible to avoid capture by carrying out the stipulated Admiralty instructions.”

‘ As for the U 29, a fortnight later she

was reported by the British Admiralty as having been sunk with all hands.

‘Had the master of the *Headlands* been provided with a gun, he would have had another story to tell; such a story, for instance, as the record of the little steamship *Atalanta*.

‘On a wild autumn morning in the following year the *Atalanta* was pounding down Channel against a full north-westerly gale, when the master descried a boat, now swung to the crest of a wave, the crew pulling steadily, now swallowed up from view. The master altered course to pick up the castaways, and manœuvred the steamship to put the boat under her lee. A rope was flung to the men, and they climbed on board, eleven French seamen from the sailing ship *Maréchal de Villars*, which had been sunk by an enemy submarine.

‘The Frenchmen were rescued at about ten o’clock on the morning of September 11th, 1916. Three-quarters of an hour later the master sighted a German sub-

marine. Her square, slate-coloured conning-tower, rounded at the fore-end, was forging through the breaking sea, off the starboard bow of the *Atalanta*, between two and three miles distant from her.

‘The master of the *Atalanta* altered course to put the submarine astern, ordered full speed and posted the gun’s crew at the gun, mounted on the quarter.

‘The submarine fired. The range was about 5000 yards, and the shot struck the sea short of the *Atalanta*. The submarine fired again, and again the projectile fell short. The range had decreased to about 4000 yards, and the *Atalanta* fired at the submarine, the shot falling short of her. After an interval of five minutes the enemy fired again, and the *Atalanta* courteously replied. There was a third exchange, and then the submarine, with a parting shot, went about and headed for a steamer then visible on the horizon. The *Atalanta* went on her way. On this occasion three rounds sufficed to discourage the enemy.’

XI

IN the meantime, during the summer and autumn of 1915, the Paravane officers in the *Oven*, armed with the permission of the Admiralty to obtain the new gear, did actually obtain it, and obtained it without incurring the lavish expenditure of time demanded by the official procedure imposed upon *Vernon*. That such permission should have been granted at all, involved so courageous a departure from precedent, that great credit is due to the Admiralty; and in this connection, the present writer is informed that the Assistant-Director of Contracts, Mr. Percy Minter, was most courteous and helpful.

The Admiralty, by allowing the Paravane officers to negotiate directly with private firms for small quantities for experimental purposes, opened a postern door of escape from the castle of official-

dom. Through that little door the Paravane officers went out into the strange land of industry, unvisited by the Admiralty. Under the Admiralty system, the private firm is scheduled as an object of suspicion, and labelled dangerous. The assumption is that the private firm will, if possible, get the better of the Admiralty; from which assumption follows this further assumption, that the Admiralty in the public interests must try to outwit the private firm—a contest in which the Admiralty almost invariably lose.

When therefore an amiable Paravane officer walked into the firm's private room, addressed the firm as one of God's creatures like himself, and manifested an acquaintance with real business, the firm was at first astonished out of measure and then highly gratified.

Under these new and happy conditions, the proposal laid before private firms up and down the country was that (it being war-time and all) they should accept orders in advance of actual official author-

isation ; that as to price, it should be fair ; and that (in a word) the whole business should be transacted as between one honest man and another. Is it necessary to say that the innovation, which would have shaken the Admiralty (in those days) to its foundations, was wholly justified ? Hardly. At the same time, there is no denying that the Paravane officers were taking a risk. But so was the Admiralty system, which was all unawares risking the defeat of this country, not to mention the defeat of other countries. Burney and the other Paravane officers were quite conseiously risking their heads. But a system is seldom actively malevolent. It does not consciously desire to impede, hinder or paralyse. It does not desire anything at all. It is simply a machine kept in motion by thousands of persons, most of whom hate it. And in the event, orders given in advance by *Vernon* were in fact ratified by the system. If the system occasionally demanded an explanation of strange manifestations which

it vaguely apprehended, and which it dimly suspected of being not quite right, that explanation was promptly furnished, according to official procedure.

But during this period, the lack of proper clerical and drawing staffs both prevented progress and imposed immense labour upon the Paravane officers. Early in the morning they went by boat to *Vernon*, there to toil in the Oven. Burney and Lieutenant McConnel journeyed about the country visiting private firms. Lieutenant D. in the austere regions of the higher mathematics worked on design. Commander W. and Lieutenant Bowles strove incessantly with correspondence and reports. Lieutenant B. went daily to sea experimenting in a destroyer. Work was continued far into the night.

One of the Paravane officers, who has retired from active service, thus described the day's work.

‘ We sat all day in the Oven, in that narrow oak-beamed cabin, all crowded

together, from about nine, when the first boat came from the Dockyard, to half-past eleven at night, when the last boat left for the shore. Burney and I lived in the Dockyard. When we came back at night, Burney went on writing as though he had done nothing all day, until long after midnight, when I turned in, if I could. Breakfast must be finished, and we must be on board *Vernon* by 8.50, but Burney was out long before that, going round the shops in the Dockyard, and stirring up the draughtsmen lent by the Director of Construction. The draughtsmen of course hated being taken off other work for Burney, who hustled them perpetually. Every now and again they would "refuse to work for Lieutenant Burney." Then it fell to W. to compose matters. There can be no praise too high for W. As Commander, he was responsible for all the Paravane business, and if that business was to be done at all, W. was obliged constantly to accept responsibilities which might seriously have prejudiced

his prospects in the Service. Burney was taking responsibilities too, but Burney was always perfectly confident that whatever obligation he incurred, he could make good as indeed he did. Burney, moreover, had the excitement of an adventure.

‘But W. had to trust to Burney; he worked always in the shadow of uncertainty; and in the meanwhile he must make war exigencies square with the authorities, and perpetually decide what to do in new emergencies. He had to deal with reams of official correspondence, the voluminous correspondence with private firms, draw up reports, formulate requirements, pacify bewildered officials, decide what to do with the pieces of gear continually arriving by train for inspection, generally to organise everything and keep every one in a good temper. Perpetually harassed and heavily tried as he was, I never saw W. shaken. He lived in *Vernon*, and except for an occasional walk on Sunday afternoons, he never left the ship for weeks on end. Often he did not

knock off for meals, a tray of sandwiches or biscuits or something was shoved on his desk. . . .

‘One emergency occurred when W. and Burney were away at Scapa. The Grand Fleet wanted a new kind of practice mine which, if it was drawn inwards by the ship cutting the mooring wire, would not damage the propeller. We designed a soft-shell mine, had it made in a balloon factory in London, tested it at sea, found it could keep its depth, all as calculated, and sent twenty mines to the Grand Fleet inside three weeks. They were delighted. Reckoning on the usual procedure they hadn’t expected a supply for nine months or so. . . .’

And all the time, amid a thousand preoccupations, Burney was inventing improvements and pondering the needs of the war. The solution of a problem would come to him at two o’clock in the morning, and by nine, a dishevelled officer, a slide rule sticking out of his jacket,

would be going up the side of *Vernon* musing upon a half sheet of paper scrawled upon with priceless hieroglyphics.

During this period, besides his designs for the High Speed Submarine Sweep, and for the use of the Paravane as a mine-deflector, Burney framed a design for developing the long-distance hydrophone, and for a special type of mine.

Then, in February 1916, came that visit of Commander W. and Lieutenant Burney to the Grand Fleet, briefly recounted at the beginning of this narrative, as the critical moment of the whole enterprise. Admiral of the Fleet Lord Jellicoe describes in his book how the freedom of movement of the Grand Fleet was impeded by mines, and in his judgment the most urgent need of the moment was the application of some new weapon which would restore to the Fleet that mobility in default of which the command of the sea could not be made good.

The great danger, then and subsequently,

was lest a command of the sea able to deny the sea to the trade of its enemy, might be increasingly unable to secure the safety of the sea for its own.

So W. and Burney, in February 1916, went up to Scapa Flow to demonstrate to the Grand Fleet the use of the mine-protector Paravane. Experimental trials were made daily in a destroyer for a fortnight; lectures were delivered; and the authorities then decided that the new device would work. Burney, however, knew that there was one thing lacking to make the mine-protector Paravane absolutely efficient, which had still to be invented; but he also knew that ere the gear was actually manufactured, he would have invented it. As, in fact, he did. Lieutenant Bowles was present at the moment, which was two o'clock in the morning. Burney, reclining in a chair, apparently dozing, sat up, and said, 'I've got it!' He drew IT on a half sheet of paper, then and there. But this is to anticipate.

The Commander-in-Chief of the Grand Fleet reported to the Admiralty that the Paravane was demonstrated to be suitable for the protection of H.M. ships against moored mines, and proposed that the manufacture of the mine-protector Paravane should be begun. The proposal was approved by the Admiralty. This, then, was the crisis in the development of the Paravane. It had been tested before Sir John Jellicoe and was approved by him. And thenceforward the Paravane officers had his powerful support.

Immediately the enterprise swelled to formidable proportions. The Fleet alone required six or seven hundred sets of the new gear at once. The Oven had achieved miracles ; but without a staff, without draughtsmen, without executive powers, how could it equip the British Fleet, not to mention other navies and the merchant ships of the world ?

XII

IN order to deal with the vast operations required, it was obviously necessary to prepare an organisation for the purpose. Sir John Jellicoe therefore directed Lieutenant Burney to devise a scheme. There and then, Burney formulated the scheme for the constitution of the Paravane department, which in outline was as follows :

The new department should be formed at the Admiralty and placed under the Admiral of Mine-sweeping ; it should take charge of all anti-Mine and anti-Submarine devices ; it should be empowered to design, develop, purchase and install all such devices ; it should be divided into two sides, the one under Lieutenant Burney, charged with the design, development and manufacture of apparatus ; the other,

under Commander W., for the trial, allocation and installation of apparatus, and for the instruction of personnel in every ship fitted; a factory should be built, and a proper staff of officers, designers, draughtsmen and clerks should be provided.

Sir John Jellicoe himself submitted the draft scheme to the Admiralty. The Admiral of Mine-sweeping, Rear-Admiral the Hon. Edward S. Fitzherbert, being directed to formulate the scheme in detail, sent for Commander W., and, by the end of February 1916, was formed the new Paravane Department under the Admiral of Mine-sweeping. Early in March the department was working.

During the whole tenure of his command, Rear-Admiral Fitzherbert took the utmost pains to ensure that the original organisation of the department was maintained and to smooth and expedite its work.

A part of the War College building in Portsmouth Dockyard was then allocated to the use of the Paravane department.

The War College was inhabited by the Dockyard police. These estimable members of the Metropolitan Police Force were not sorry to turn out, because if they were billeted in the town, they received lodging allowance. But the Dockyard authorities had no such motive for repairing, cleaning and furnishing the War College to lodge a strange department of which they knew little more than the name.

They could not be persuaded that the Paravane officers, hitherto huddled into the Oven in *Vernon*, required as well as other accommodation the large room on the ground floor. Whereupon the Paravane officers demonstrated that the room was needed, by equipping it as a Museum. When the inspecting officer arrived he perceived an array of Paravane gear, pieces of machinery, bits of iron, coils of wire, and the like, all neatly labelled, and he was met at the door by a working party of seamen bearing a Paravane into the Museum. At every door he met likewise a working party of seamen

bowed beneath a Paravane. Probably the inspecting officer concluded that there were several Paravanes arriving ; although in fact there was only one. In any case, he was convinced that the room was required. Soon afterwards, the Paravane officers discovered that what they really wanted was, not a museum but, a central clearing office.

It was now necessary to equip the new department with drawing desks, boards, instruments, and all the requirements of a large staff of draughtsmen. Lieutenant Simpson, Royal Naval Volunteer Reserve, was appointed to purchase the equipment, and to engage draughtsmen. Mr. Simpson, by profession a civil engineer, had been employed on hydrophone work in *Vernon*. An officer owning high technical ability and some experience in dealing with private firms was found in Lieutenant-Commander (now Commander) G. W. P. (E), Royal Navy, who was then assistant-engineer-manager of Chatham Dockyard. Lieutenant-Commander P. had served

with Burney in the anti-Submarine Committee appointed in 1910, and had worked with Burney at Sir George White's experimental aeroplane establishment at Bristol, for a year, on half-pay. Lieutenant-Commander P. was charged with the technical side of the production in dealing with private firms, while Lieutenant (now Lieutenant-Commander) McConnel, who had already worked for some time in *Vernon*, continued to conduct the commercial side.

Later, Mr. Huskisson, chief designer at Crossley's gas-engine works, entered the Paravane department as chief designer.

Burney visited Professor Lewis at the Royal Naval College, Greenwich, and Professor Lewis, taking great interest in the work, very kindly enabled Dr. Haigh to come regularly to Portsmouth to help in the recondite experimental physics and chemistry required to ascertain the precise constituents and strength of materials. Thus Dr. Haigh, in the Service phrase, was lent by the Royal Naval College, in

whose laboratory he was able to conduct tests and analyses.

One of the most difficult problems to be solved by the Paravane officers was the constitution of the towing wire. At first every wire broke after a few hours in the water. The fracture was not due to strain but to the tremendous vibration, which destroyed the fibre of the steel. Wire manufactured to withstand a breaking strain of ten tons would break in three hours at a strain of three tons. Experiment after experiment was tried to lengthen the life of the wire. Dr. Haigh's work in this research was invaluable. He visited nearly all the wire-making firms in the country; conducted experiments at Greenwich; worked out the mathematics of the curve assumed by the towing wire; and in three months produced a wire with a life of a hundred hours.

At this time, too, Lieutenant-Commander (T) F. R., Royal Navy, joined the Paravane department for theoretical work and design, as Burney's assistant. Lieu-

tenant-Commander R. had been on the staff of *Vernon*, and at the time of his appointment to the Paravane department, he had returned from service in the Dardanelles.

Lieutenant-Commander R. relieved Lieutenant V. H. D., who was appointed Paravane officer to the Grand Fleet, and who was attached to the staff of the Rear-Admiral, First Battle Squadron, Rear-Admiral William C. M. Nicholson, who had been captain of H.M.S. *Vernon* before the war, and who was President of the Paravane Committee of the Grand Fleet. When the fitting of the Grand Fleet with Paravanes began, Rear-Admiral Nicholson established the organisation of Paravanes for and in the Grand Fleet. That organisation was in direct communication with the Paravane department at Portsmouth. When the Paravane, on the way to the Grand Fleet, appeared on the horizon, Rear-Admiral Nicholson took charge of it. Rear-Admiral Nicholson was thus able to ensure the standardised fitting of ships,

which was essential. The present writer trusts that Admiral Nicholson will forgive him for mentioning his name in connection with services to whose value the present writer has received much grateful testimony.

Thus, in the spring of 1916, the Paravane department was fairly under way in the War College, the square and sombre building secluded in a corner of the Dockyard, beside the lagoon in which disused man-of-war boats rot at ease, and looking upon the shaven lawn spread before the house of the Commander-in-Chief. Its green-painted chambers were speedily filled with officers, designers, draughtsmen, tracers and clerical staff, both men and women, all under the command of Commander W., now officially designated Paravane Commander. W. was responsible for the organisation of the whole department; Lieutenant Burney was responsible for experiment and design; Lieutenant-Commander G. W. P. was responsible for technical dealings with

private firms ; Lieutenant McConnel was responsible for the financial and business dealings with private firms.

By the time the Paravane department was established in the War College, it was dealing directly with about a hundred private firms, and was receiving about four hundred letters a day.

The department was enlarged by the erection of an extensive hut adjoining the main building. Altogether, there were more than forty offices, a lecture theatre, and a workshop for experimental purposes. Attached were two destroyers, a torpedo-boat and several small craft for experimental work and for testing Paravanes at high speed. Every Paravane was thus tested before it was issued to the Fleet.

The staff ultimately numbered more than three hundred : naval officers, civil engineers and assistants, draughtsmen, clerks and messengers.

The Paravane department, thus constituted, conducted the following operations :

Experiment and Design. Entirely controlled by Paravane department.

Manufacture and Progress. Almost entirely controlled by Paravane department.

Testing. Entirely controlled by Paravane department, which tested every Paravane at Portsmouth.

Distribution. Entirely controlled by the Paravane department for a long time, except as regards packing and despatch, which were done by the Naval Store department, under the direction of the Paravane department.

Installation in ships. All drawings were made by the Paravane department, whose officers visited each ship and arranged the fitting with the ship's officers.

Instruction. Entirely controlled by the Paravane department.

The Paravane department was in constant communication with officers using the gear at sea, and was thus able to benefit by their experience. The Paravane officers of the Fleet and of the destroyer

flotillas were all trained by the Paravane department at Portsmouth. When an alteration in the gear was required, Experiment and Design devised it, and then each sub-department carried it forward to completion.

XIII

BEHOLD the Paravane department now a department within a department, subject to the Admiral of Mine-sweeping, or A.M.S. (afterward D.T.M.) at the Admiralty. In March 1916, Lieutenant-Commander B. V., Royal Navy, from H.M.S. *Shannon*, was appointed Paravane officer under Rear-Admiral the Hon. Edward S. Fitzherbert, A.M.S. Thus A.M.S. had a Paravane department at the Admiralty, through which went all transactions conducted with the Admiralty by the Paravane department at Portsmouth.

But it is one thing to constitute a department and quite another to endow it with full discretionary powers. Under the new arrangement, the system of ordering gear through the Dockyard authorities had disappeared. But the perpetual difficulty of the expenditure of time in-

volved in the official procedure remained. And time was of indescribable value. Every day's delay in the equipment with Paravanes of the Fleet was a day's advantage to the enemy. Every day's delay in the equipment of merchant ships with the Otter (the merchant service variety of the Paravane) cost loss of ships and cargoes and very often lives of men.

The Admiralty procedure was designed to exercise a strict and a necessary control over expenditure. But the exercise of that control in time of war disastrously hindered the conduct of the war at sea. In the case of the Ministry of Munitions, not to mention other departments, financial control, under the stress of war, was virtually renounced. In the case of the Admiralty, an expenditure of millions was involved. Was that expenditure to be confided to the sole discretion of a new sub-department at Portsmouth? But if not, there would be disastrous delay. The dilemma was complete.

In these circumstances, the Paravane department was authorised by the Admiralty to place orders with private firms for experimental purposes up to a small specified amount. The Paravane department, in order to save time, had already instituted the practices of ordering gear in advance of official authorisation, and of dealing directly with private firms, of which they now had about a hundred on their list. Under the new arrangement, they continued these practices, incurring a considerable expenditure. What else could they do ?

The Paravane officers were risking their careers. The private firms were risking their money. For, understanding the extreme urgency of the case, private firms agreed in almost every instance to prepare their plant in advance for the execution of orders. That preparation involved the costly process of making what are called jigs, of making special gauges, and of erecting special plant.

In 1916, the fortunes of the war were

dubious enough. The Germans were attacking Verdun. The British victory of the Battle of Jutland had not served to abate the violence of the submarine war on commerce. Earl Kitchener, on 5th June, was lost in H.M.S. *Hampshire*, mined or torpedoed. On 1st July began the great battle of the Somme. The losses of ships steadily increased. The war losses among British steamships of 1600 tons gross and upwards were : in January, 13 ; in February, 14 ; in March, 16 ; in April, 32, or a ship a day ; in May, 15, a ship every two days ; in June, a drop to 9 ; in July, a rise to 21 ; in August, 14 ; in September, 25 ; in October, 32, again a ship a day ; in November, 26 ; and in December, the largest monthly loss hitherto on record, 39. Total for the year, 256 ships.

The number of foreign ships was nearly as great. In gross tons, during 1916, foreign countries lost 1,300,018 ; Great Britain, 1,497,848 ; in all, 2,797,866 gross tons. In the fourth quarter of 1916, the

total loss of gross tonnage, British and foreign, doubled any previous quarter, the amount being 1,159,343 gross tons. This loss was inflicted after the victory of Jutland, which drove the main battle fleet of the enemy finally from the sea.

Numbers and tonnage are highly abstract statements. Let us once more study the progress and the development of that war on commerce to defeat which the Paravane officers were furiously toiling, while the newspapers were loyally exhorting the public to trust in the Navy. They were right, but they did not know they were right, for they knew nothing of the Paravane department. Even the Navy knew hardly anything of it. When the Paravane department began its independent existence in the War College, it was regarded as an unamiable eccentricity likely to give trouble to the orthodox industrious officer.

But what was happening at sea ? Here follow some brief examples from *The Merchant Seaman in War*. The case of

the *Cabotia* illustrates at once the daring and the cruelty of the German submarine officers.

‘The submarine prefers to attack in fine weather. It is pleasanter for all parties concerned, and much easier. The reports usually record weather fine and clear, light airs, slight swell. But the *Cabotia* was attacked and chased in a North Atlantic autumn gale.

‘She left the United States on October 9th, 1916, carrying some 5000 tons of cargo, consisting of wood pulp and 300 horses, and steamed at once into a gale. It blew hard, with a heavy sea, almost without cessation, and after eleven days blew harder. On the 20th, a full gale was blowing from the south-west. The *Cabotia*, steaming east, was holding a zig-zag course at ten knots, pitching and rolling, the sea continually washing over the decks. The master, the chief officer, and the second officer were in the chart-house, working out the position of the ship taken

by observation at noon. They made out that she was 120 miles from the nearest land, or twelve hours' steaming. These were the dangerous hours. If nothing happened during the day, by midnight the ship would be safe.

'The third officer was on watch on the bridge, where an able seaman was at the wheel. An able seaman was looking out on the forecastle head, scanning the broken hills of water rising and falling away to the grey horizon.

'Suddenly, across the smother, the lookout saw a dark and glistening object emerge. It was about three miles away on the starboard bow. The officers left the chart-house; the master went on the bridge; and all deck-hands were summoned on deck. The master put the ship right about, bringing the submarine astern. The submarine fired, and continued to fire at intervals of about five minutes, while she manœuvred to get on the *Cabotia's* quarter. But the master of the *Cabotia* kept a zig-zag course, and man-

œuvred quicker than the submarine, so that the chief officer presently said that he thought the *Cabotia* could escape. She was unarmed.

‘The movement of the ship, turning swiftly to port and starboard alternately in a beam sea, was very violent. The sufferings of the horses penned below are not described, but they may be imagined. The engineers and firemen, as usual, stuck to their work and kept the ship at her full speed of ten knots. It is uncertain whether or not the ship was hit during a chase which thus furiously proceeded for an hour and a half. But the officers of the *Cabotia* clustered on the oscillating bridge were staring aft at the shape astern. It was now buried in flying water, the gunner at his gun plunged up to his neck in the sea, now emerging and firing with a sullen flash and a detonation torn by the wind; and the people in the *Cabotia* perceived that in spite of her difficult manœuvring, the submarine had three knots the better in speed, and was overhauling them.

‘The master ordered the boats to be swung out, and dropped his confidential papers overboard. No one thought the boats could live in the sea then running ; but they were the only chance. The wireless operator had been constantly making the distress call, and a little before two o’clock he received an answer.

‘But by that time the submarine was close under the stern of the *Cabotia*, and she put a shell through the *Cabotia’s* funnel. Then the master stopped engines, hoisted the signal that he was abandoning ship, and ordered the crew into the boats.

‘Here was another test of discipline and seamanship, to get the boats away from the rolling vessel, in that frightful sea, under the continual fire of the submarine. Among the seventy-four men of the crew, besides British, were Greeks, Italians, Portuguese, Americans, Danes and Norwegians ; and all “behaved splendidly.”

‘There were four boats, each having a week’s provisions on board, and all were

safely launched. The boats were in charge of the master, chief, second and third officers respectively. In that sea it was all they could do to keep their boats afloat, and they were immediately separated each from the other.

‘The second officer, who with his men expected every instant to be drowned, kept his boat before the sea, the men pulling to keep steerage way on her, and so waited for orders from the master. He saw the submarine go alongside the third officer’s boat, and speak to the third officer. Then the submarine went close to the *Cabotia* and fired twelve shots into her. The *Cabotia* settled slowly down, and about half an hour afterwards she was gone.

‘About the same time the second officer sighted a steamer. He hoisted a shirt on the mast, and pulled hard towards her. The steamer stopped, but made no reply to the signal of distress ; and the second officer, tossing desperately within a few hundred yards, saw the submarine go

alongside the strange vessel. She carried neutral colours painted on her side, and a black funnel with a deep white band.

‘Without taking the slightest notice of the boats, the steamer got under way, saluted the submarine with a blast on her whistle, and departed. No explanation of these circumstances is available. That was what happened.

‘The second officer, abandoned to his fate, kept the boat before the sea, and looked for the other boats, but he could not see them. It was then about three o’clock in the afternoon. Four terrible hours later heavy rain began to fall, and the sea moderated a little. The second officer then steered for land, about 120 miles distant, the men pulling steadily all night. When the ragged daylight dawned on the desolate sea, the second officer set sail, and made good way in comparative ease. At nine o’clock that morning the second officer sighted a patrol boat right ahead. A few minutes later the second officer and his sturdy crew were safe on

board the patrol boat, and the drenched, cold and exhausted men were sitting down to a hot breakfast.

‘In the meantime the chief officer’s boat had gone through much the same ordeal. When the second officer pulled towards the strange steamer the chief officer was astern of him and further away from the vessel. The chief officer also made signals of distress, hoisting an apron. Like the second officer, he saw the steamer stop, noted her neutral colours and the white band on her funnel, saw the submarine draw alongside and converse with her, saw her depart.

‘At that time the master’s boat and the third officer’s boat were within sight of the other two, and all remained in company, though widely separated, drifting northwards, stern to sea, until dark.

‘When daylight came the chief officer’s boat was alone. The chief officer hoisted sail and laid his course for the land.

‘The second officer, on coming on board the patrol boat, of course reported the

situation to her captain, who immediately steamed in search of the other three boats. Within twenty minutes the chief officer's boat was sighted, a little and solitary sail cleaving the wandering waters ; and presently he and his party were safe on board the patrol.

‘ All that day, all the night and all the following day the patrol vessel cruised in search of the master's and the third officer's boats. They were not found. The second officer still held to a hope that they had been driven far to the north and would be rescued or make a landfall. But they were never seen again.

‘ Thirty-two officers and men went down on that night of storm ; thirty-two out of seventy-four. In such a sea, a small boat with little steerage way might be pooped at any moment ; that is, being continually followed and overhung by huge seas, she might fail to rise to the next sea in time, when the following wave would fall upon her, sending her to the bottom like a stone.’

The next record, containing the adventures of the master of the *Seatonia*, who was taken prisoner by a German submarine, illustrates the methodical and uninterrupted working of the submarine system.

‘*Morning of November 1st, 1916.*—A steamship rolling in the long swell of the North Atlantic, pursued by shots fired from astern by an invisible enemy. The *Seatonia* slipped this way and that like a hunted animal, the master scanning the hills of water rising and falling, until he saw the submarine. She was then some seven miles distant. Smoke, shot with flame, continually burst from her guns, and shells sang about the *Seatonia*, falling nearer and nearer. So, for nearly three hours. Then the submarine, running close on the steamer’s beam, signalled “Abandon ship.”

‘The master stopped engines and ordered the two boats away. Fourteen people went in the port lifeboat, seventeen

in the starboard lifeboat, including the master, who was the last to leave the ship.

‘ The port lifeboat was in charge of the chief officer and was first away. The submarine then hoisted the German ensign, and two small flags ; and as the master’s boat was launched, the submarine officer ordered her to come alongside. The chief officer, standing off, saw the master and the rest of the people in the starboard lifeboat taken on board the submarine, and the lifeboat cast adrift. Whereupon the chief officer got under way, steered east by north, and (to make an end of his adventures) was picked up two or three hours afterwards by a neutral steamer, and subsequently landed in a neutral port, whence, with the thirteen men under his command, he came home in due time.

‘ The master and the sixteen others of the crew of the starboard lifeboat were sent below in the submarine, so that the master did not see his ship sink ; but he heard the “ cough ” of the discharge of the two torpedoes which sank her. The

chief engineer of the *Seatonia*, who was also below, says he saw the torpedoes fired. The submarine then submerged and the English and the other nationalities of the *Seatonia's* people were alone with the Germans in that narrow cylinder, intricate and glittering with pipes, wheels, valves and every kind of mechanism.

‘The commanding officer of the submarine was of sallow complexion and sharp of feature, looking about forty years of age. The first lieutenant was about thirty, a fair man of middle size. The second lieutenant, a dark, clean-shaven young officer, had (he said) lived for some years in Nova Scotia, and spoke good English.

‘The crew numbered forty-six. They wore thick felt-lined brown coats and trousers, made of rubber or waterproofed leather. The internal fittings of the vessel were stamped V 49. Externally she carried no number, and was painted the usual grey.

‘The master said no word, bad or good,

of his experience on board the enemy submarine. It is certain that he must have suffered a good deal of discomfort, for there is no accommodation for passengers in a submarine, and little enough for the crew. The commanding officer and first lieutenant may have had fitted bed-places ; the other officer and the men slept on the floor. On that night of November 1st, the people of the *Seatonia* must have been packed like herrings, and the air must have become very dense. It seems that they were hospitably treated. The commanding officer asked many questions of the master, who, if he were like other masters, did not illuminatingly respond. The lieutenant who had dwelt in Nova Scotia appears to have been socially disposed.

‘ At eight o’clock the next morning, November 2nd, the submarine captain invited the master to come up on deck. There, in the keen air and sudden daylight, the master beheld three British steam trawlers tossing on a heavy run of sea.

These were the *Caswell*, *Kyoto*, and *Harfat Castle*. But the master had not been asked on deck to admire the view. The submarine officer had already made his arrangements, and the master was part of them. The men of the *Caswell* were ordered to bring their boat alongside, and the submarine officer ordered the master to visit each of the three trawlers, to estimate the amount of coal in their bunkers, and to open the sea-cocks, in the two which had least coal, and so to sink them. Such, at least, was what the master understood he was to do.

‘The master had no choice but to obey. So he went away in the *Caswell’s* boat. The crews of the other two trawlers were getting away in their boats. No sooner was the crew of the *Kyoto* clear of her than the master was startled by the report of a gun, and saw a shell strike the *Kyoto*. The submarine fired into her till she sank. Apparently the German officer decided to hasten the good work.

‘Then the master perceived another

steam trawler coming up. She looked like an Icelandic boat, was named *Bragi*, and was flying Danish colours. He afterwards discovered that the Dane had been captured by the submarine four days previously, and was then under the command of a German lieutenant, with an armed guard of three men. The *Bragi* was acting as consort to the submarine. She lay to, and the submarine officer set the crews of all three trawlers and some of the *Seaton*'s crew to shifting coal from the two remaining British trawlers, *Caswell* and *Harfat Castle*, to the *Bragi*.

‘There was a considerable sea running, and the forced working party must hoist the coal from the bunkers, lower it into the boats, pull the boats across to the *Bragi*, hoist the coal on board her, return and do it all over again—a hard and heavy job. The Germans looked on.

‘The master makes no remark upon this procedure. The work went on for about six hours, and was finished at half-past four in the afternoon. Then the

black, wet and weary men were ordered on board the *Bragi*, which thus received the crew of the *Seatonia* and the crews of the three trawlers. The master of the *Seatonia* was kept on board the submarine.

‘The submarine officer ordered the master of the *Bragi* to come on board, gave him his instructions, and sent him back to his ship. The trawlers’ boats were hoisted on board the *Bragi*, and the two remaining trawlers, now gutted of coal and supplies, were sunk by gunfire. The *Bragi* got under way and departed.

‘The master of the *Seatonia* was left alone with his German captors in the submarine.

‘The master was allowed on deck when there was no ship in sight, and he admired the seaworthy qualities of the submarine. She was much on the surface, both by day and night; during the whole time the master was on board it was blowing hard with a heavy sea; and he considered that the submarine “worked on the surface in a most weatherly way.”

‘When a vessel which might have been an enemy was sighted the submarine dived, somewhat, it must be supposed, to the master’s relief; for if she was hit and sunk he would infallibly go down with her, and it would have been a pity to be drowned by one’s own people.

‘Twice, during the night of November 3rd, the master’s third night on board, firing went on over his head on deck. Two ships were attacked, and so far as the master could discover, unsuccessfully. In preparing to attack, the submarine always submerged so soon as the ship was sighted, then rose again to fire at her.

‘The next night, the 4th, another vessel was attacked. Nothing more seems to have happened till the night of the 7th, when the master understood that the submarine was firing on the U.S.A. steamship *Columbian*.

‘Next day, November 8th, the submarine forced a Norwegian steamer, the *Balto*, to stop and wait for orders. Then the submarine once more attacked the

Columbian, compelled the crew to abandon her, sent them on board the Norwegian, and then torpedoed the *Columbian*.

‘That was an interesting day for the British master. In her, but not of her, he watched a first-class pirate at work. The next day, the 9th, was also variously destructive. The submarine stopped a Swedish steamer, the *Varing*, and to her transferred the crews of the sunk *Columbian* and of the *Balto*. Thus it became feasible to sink the *Balto*; and accordingly bombs were exploded on board her, and she sank about noon.

‘The master of the *Seaton* was now released from captivity and sent on board the *Varing*, where there were already 134 people, in addition to the crew. The master made the 135th. The same afternoon 25 more persons joined the party, making 160 captives in all. For the submarine had forced the crew of the Norwegian *Fordelen* to abandon her, sent them to the *Varing*, and sunk the *Fordelen*.

‘The submarine officer sent a prize crew

on board the *Varing*, and at midnight the German officer in command of the *Varing* suddenly sighted a British vessel of war, and at once cleared the upper deck of all passengers.

‘During the nine days of the master’s captivity the submarine sank the *Seatonia*, the three trawlers *Caswell*, *Kyoto* and *Harfat Castle*, the neutral vessels *Columbian*, *Balto* and *Fordelen*, seven in all, and captured the *Varing*. She had already captured the Danish trawler *Bragi*, which was acting as consort. The disposition of the captured crews was ingenious. The *Seatonia*’s people went to the submarine herself, thence to the Danish consort. The *Columbian* was not put down until provision was made for her crew in the *Balto*. The crews of *Columbian* and *Balto* were both transferred from the *Balto* to the *Varing*, and then the *Balto* was sunk. The crew of the *Fordelen* also went to the *Varing*, and then the *Fordelen* was sunk.

‘The commanding officer of the submarine thus preserved the lives of the

people whose ships he destroyed, making no distinction whatever between belligerent and neutral ships. The master of the *Seatonia* was treated, not as a prisoner of war but, as a civilian prisoner. As he had not fired upon the submarine—having indeed no gun—he did in fact retain his civilian rights, which were respected.

‘The next morning, November 10th, the master, with one of the captive crews, was landed in a neutral port.

‘In the meantime the *Bragi*, according to her instructions, arrived on November 5th, off a neutral port, which was her rendezvous. The next day the submarine fetched up with the *Varing* in company. The master of the *Bragi* was again summoned on board the submarine, where he received his dismissal from the German service. He afterwards landed his passengers in a neutral port, and so departed on his own affairs, carrying in his mind a powerful objection, mentioned by the submarine officer, against carrying fish for England.

‘The use made by the Germans of neutral ships and neutral ports would seem to add a new meaning to the accepted notion of neutrality.’

By this time too, the Mediterranean, once the proudest station of the British Fleet, was being ravaged.

‘The master of the *City of Birmingham*, left alone on board his ship, which was sinking under him, collected his confidential books and papers, stowed them in a weighted bag, went on the bridge and hove them overboard.

‘Pulling away from the ship over the smooth swell were seven boats laden with passengers. Across the water floated the pleasant sound of women’s voices, singing. . . .

‘The sound was a gracious, unconscious testimony to the master’s forethought, skill and hardihood. A little more than ten minutes ago all the people in the boats had been snug in the ship, which was

steaming peacefully at thirteen knots : all men on duty at their stations, everything correct, no sign of an enemy. There were a crew of 145, of whom 29 were British and 116 were Lascars, and passengers numbering 170, of whom about 90 were women and children. There was no warning ere the torpedo struck the vessel.

‘The master on the bridge perceived that the after half of the ship was under water. He had stayed by his ship to the last, and now it was time for him to go. He swung himself from the bridge and ran to the forecastle head, and as he reached it the ship went down, taking the master with her. He came to the surface, struck out, swam to a couple of floating planks, and clung to them. It was November 27th, 1916, and the water of the Mediterranean was very cold.

‘To the master, adrift on the last remnant of his fine ship, still came the sound of women’s voices, singing ; but they seemed very far off. Rising and

falling on the long slopes of the swell, the master could see the boats no longer. It occurred to him that they could not see him, either. Would they conclude he was drowned with his ship? Would each boat think the other had him on board? Would he be left to perish, alone among the people in the ship, the people whom he had saved?

‘Swinging drenched on his wreckage, the master saw again the white decks, the lookouts at their stations, the gunners standing by their gun, and felt again the tremendous blow of the torpedo, striking fifteen feet under water, and the trembling of the wounded vessel. Then began the test of his drill and organisation. Every officer and man went to his boat station; all passengers, lifebelts slung upon them, went as steadily to their boats as the crew. The engineer reversed engines and stopped the way of the ship, though the steam was pouring out of the saloon windows; the wireless operator sent out calls and received a reply; the boats were swung

out and safely launched. And all inside ten minutes.

‘No master could have achieved more. And there he was adrift. Where were the boats? Minute by minute passed and no boat came. “He saved others. . . .” But still the sound of women’s voices, singing, hung in the air. So soon as they were in the boats, they struck up that brave chant, to show that all was well, and that nothing dismayed them.

‘The master, after the manner of the British seaman, continued to hang on, let come what would come. Half an hour may be as half a year to a drowning man. And the remorseless interminable minutes lagged one after another to nearly thirty ere the master caught the beat of oars, and beheld the prow of a boat cleaving the crest of the swell above him.

‘Once on board the boat the master instantly took command again. He signalled to the other boats to come together, and ordered them to pull eastwards, where a plume of smoke blurred the horizon.

‘The steamer was presently observed to be approaching, and by four o’clock the whole of the shipwrecked people were on board the hospital ship *Letitia*. The *City of Birmingham* had been torpedoed at 11.15; every soul on board except the master was clear of her ten minutes later; at 11.45 she sank, and by four o’clock all were rescued.

‘So soon as the people were on board the *Letitia*, the master called the roll of the passengers and mustered the crew. He found that four lives in all had been lost between the time of the explosion and the pulling away of the boats. The ship’s doctor, who was an old man; the barman, who seems to have been of an unstable temperament, and who fell into the water; and two Lascars: these were drowned.

‘Neither the submarine nor the torpedo was seen.

‘The master in his report stated that “the women especially showed a good example by the way in which they took

their places in the boats, as calmly as if they were going down to their meals, and when in the boats they began singing.

‘So might Andromeda have lifted her golden voice in praise to the immortal gods, what time the hero slew the sea-beast that would have devoured her.’

‘Three hundred miles from land, in the Mediterranean, a merchant service officer crouched on a raft of wreckage, staring at a German submarine, which lay within a hundred yards of him. An English ship’s boat, crammed with men, at some distance from him, was pulling towards him. The smooth sea was strewn with broken pieces of the ship, to some of which men were clinging; and a second boat was pulling to and fro, picking the men from the water. It was about half-past five in the afternoon of November 4th, 1916.

‘The chief officer, contemplating the enemy with a curious eye, beheld the long yellow hull awash, the circular conning-

tower rising amidships, painted a light straw colour, bearing a black number, indecipherable, and surmounted by a canvas screen, enclosing the rail. Five or six men, clad in brown, except one who wore a white sweater, lined the rail of the conning-tower, gazing at the destruction they had wrought. Forward, on the deck, beside the gun, two German officers were leisurely pointing cameras upon the ship-wrecked men. When they had taken such photographs as they desired, they departed. The submarine got under way and steered to a position where she lay in the track of steamers shortly due to pass.

‘The chief officer and the rest of the men were taken into the two boats. By that time darkness was gathering. The chief officer, knowing that two steamers were coming up astern, burned red flares to warn them of their danger. In so doing he risked the vengeance of the submarine, which must have seen the flares, and which could have overhauled

the boats in a few minutes, and then sent them to the bottom.

‘The two boats, overladen with the soaked and shivering crew, pulled and drifted in the dark for some nine hours. Early the next morning they were rescued by the hospital ship *Voldavia*.

‘It was at 5.25 upon the previous afternoon that their ship, the *Huntsvale*, had been struck by a torpedo fired from an unseen submarine. Her stern was blown clean off, and she sank in two minutes. The master sounded the whistle, and the wireless operator had just time and no more to send out one call of distress ere his dynamo collapsed. The master and six men lost their lives, seven killed out of forty-nine.

‘Immediately after the explosion the submarine rose to the surface and steered towards the scene of wreckage, while the German officers prepared their photographic apparatus. Doubtless the prints were designed for publication in Germany to illustrate the freedom of the seas.’

The appalling story of the *Conch* is an instance of the frightful perils to which the oil-ships were exposed, and in spite of which they continued to ply without intermission. The incident also illustrates the valour and seamanship of the naval officer. It was no fault of the destroyer captains that they could not avert disaster. The Paravane officers were doing all that men could do to give their comrades at sea the power of prevention.

‘ On the night of December 7th, 1916, in a broad moonlight, a big oil-ship, the *Conch*, was steaming up Channel. She was bringing 7000 tons of benzine from a far Eastern port.

‘ Eight miles away, nearer the coast, a patrol boat was cruising. Her captain was startled by a bright flame towering upon the night, and writhing momentarily higher amid a vast rolling canopy of smoke, blotting out the stars. The captain of the patrol boat steered for the fire at full speed. At eight knots it was an

hour or more ere the captain came in full sight of a large ship, wrapped in a roaring flame, spouting burning oil from a rent in her port side, and steaming faster than the patrol boat. From the fore-castle aft she was all one flame of fire; wildly steering herself, she was yawing now to this side, now to the other; and as she sped, her wavering track blazed and smoked upon the heaving water.

‘The heat smote upon the faces of the men in the patrol boat as they stared upon the burning ship. The captain steered nearer to her, and at the same moment she turned suddenly towards him, her whole bulk of fire bearing down upon the patrol boat. The captain put his helm hard over and turned away; and still she came on, dreadfully lighting the men’s scared faces, revealing every detail of rope and block and guardrail; and then the patrol boat just cleared her.

‘The captain stood off to a safe distance and steamed parallel to the course of the burning ship, scanning her for any sight

of a living creature, but he could see none, nor did it seem possible that so much as a rat could be left alive in that furnace.

‘After cruising thus for about an hour, and perceiving the approach of two trawlers, also on patrol duty, the first patrol boat went about her business, her captain having made up his mind that there were no men left alive in the burning ship.

‘But there were.

‘When the watch was changed on board the *Conch* at eight o’clock on the evening before, the master and the third officer went on the bridge. During that watch there were two quartermasters at the wheel; a wireless operator and a gunner were posted at the gun, aft, and there was a lookout man stationed on the forecastle head. Below, the fourth engineer was on watch, and the chief engineer was in charge. Two China boys were stoking. The rest of the officers were either in their cabins or on deck, and the remainder of the crew were in

the fore-castle, where they had their quarters.

‘About half-past ten the chief engineer was in his cabin, whence he had been going to the engine-room from time to time, when he heard the dull report of an explosion, and simultaneously felt a heavy shock. He ran to the engine-room. Nothing had happened there; the revolutions still marked ten knots, and the needle of the telegraph dial still pointed to full speed.

‘The fourth engineer ran to call the second and third engineers. Swiftly as he went, the fire caught him as he dashed into the alley-way, and he must burst his way through flame and smoke. He was shockingly burned about the hands and arms, but he roused the two other engineers, and all three hurried down to the engine-room, the whole after part of the ship blazing behind them. None of the other officers were ever seen again.

‘In the engine-room, imprisoned by fire, were the eight people of the engine-

room staff ; the chief engineer, the second, third and fourth engineers and four Chinamen ; eight of the fifty-six persons in the ship, of whom twelve were British and the rest Chinese.

‘ From time to time one of the engineers tried to force his way on deck, and at each attempt he was beaten back by the flames. Thus they tried for an hour ; and all the while the telegraph dial pointed to full speed and the ship was steaming at ten knots.

‘ It was about midnight when the second engineer succeeded in reaching the deck. He sounded the whistle. The others joined him. The bridge was a burning ruin ; flame and smoke streamed up from the forward tanks ; burning oil poured from the hull on the port side, where mine or torpedo had torn a great hole ; of the four lifeboats no sign was left except the blackened and twisted davits. To the eight men it appeared that they must either be burned alive or go over the side and end the business that way.

‘Then they remarked the dinghy secured on chocks on the well deck. Amid the heat and flame, they hoisted her out and lowered her into the sea, where she was immediately filled with water. All the time the ship was steaming ahead and yawing. The engineers tried to get back to the engine-room to stop the engines and so stop the ship ; for with way on the ship the dinghy was towing astern, and it was most difficult to embark in her. But the fire now barred the engineers from the engine-room.

‘What followed is a little obscure. But it is clear that the four Chinamen reached the boat by sliding down the falls, and that the fourth engineer, attempting to follow them, could not travel along the ropes with his wounded hands, so hung midway, unable to go forward or back, and then dropped into the sea, whence he never rose again. The fourth engineer had come by his hurt when he went to call the other two engineer officers. So he lost his life.

‘The chief engineer did not see what happened to the fourth engineer. The Chinamen in the boat told him of it. Somehow the chief engineer got into the boat, and before the second and third engineers could board her she came adrift from the ship.

‘The chief engineer and the four Chinamen were in the water-logged boat, and the second and third engineers were left on board the burning ship.

‘The people in the dinghy were not seen by the patrol boat, which was keeping pace with the *Conch* some distance away from her. The dinghy, obscured by smoke and flame, dropped swiftly astern. The chief engineer and the Chinamen kept her afloat by incessant baling; and after about an hour they sighted a steamer, rowed desperately, hailed her, and were presently taken on board.

‘The steamer pursued the burning ship with the intention of taking off the second and third engineers, but she could not approach near enough. By that time

the flames had subsided upon the after part of the *Conch*, but she was still blazing from the bridge forward.

‘What happened to the second and third engineers left on board the *Conch*, their last hope drifting away astern? At some time between about half-past one in the night of December 7th-8th, when the dinghy went adrift, and three o’clock, one of the trawlers, which had been observed by the first patrol boat to be approaching, manœuvred under the stern of the *Conch*, which was still steaming ahead, and the commanding officer of the trawler told the two engineers to jump into the water, whence he hauled them on board.

‘Thus, with the sad exception of the fourth engineer, the engineering staff was saved. So far as they knew, when they quitted the burning ship there were no men left on board.

‘But there were.

‘At a quarter to four on that Friday morning, December 8th, the lieutenant

in command of one of His Majesty's torpedo-boat destroyers sighted what he described as "a very large conflagration." Upon approaching the fire he perceived a great vessel burning fiercely from fore-castle to stern, steaming at about eight knots, and yawing through some seven points; and huddled upon the fore-peak, like the eyes of a tortured creature, a crowd of Chinamen.

'The lieutenant considered that to run his destroyer alongside a burning ship under way and out of control was impracticable. Let us now regard the seamanship of the Royal Navy.

'The lieutenant lowered all his boats and ran past the stern of the *Conch*, throwing overboard life-saving rafts, life-belts and lifebuoys, and shouting to the men to jump into the water. He turned, ran past the stern again, turned, and repeated his action. The Chinamen leaped into the water and were picked up, all except nine.

'Nine paralysed Chinamen remained

invisibly fettered to the ship, where during some five hours they had watched the fire steadily eating its way towards them. It is probable that they had taken opium. The flames, which had slackened on the after part of the ship, were now again blazing, the fire having ignited the bunkers, and the Chinamen had but a few minutes between them and death.

‘“ I therefore decided,” says the young naval officer who performed the deed, “that it was necessary to place the — alongside the ship, and take off the remainder of the crew.”

‘Then followed a feat of consummate seamanship and indomitable courage.

‘A more hazardous evolution could hardly be devised. As the burning ship was unmanageable and swerving suddenly from side to side, a collision was almost inevitable, while to go alongside a pyramid of burning oil was to risk catching fire and exploding ammunition.

‘The lieutenant, steaming eight knots, keeping pace with the *Conch*, ran right

alongside her windward bow, grappled the riven, red-hot hull, now burned almost down to the water-line. For a desperate ten minutes the destroyer was locked to the burning overhanging mass, in the reck and the fierce heat and the dropping flakes of fire, while the nine wretched Chinamen, roused from the Chinese lethargy, lowered themselves one by one from the peak of the tall vessel to the deck of the destroyer.

‘Then the lieutenant cast off his destroyer, “which sustained slight superficial damage to guardrails and upper deck fittings.” He makes no other remark of any kind. He was none too soon, for “ten minutes after the ——— cleared the steamer, the latter was burnt to the water-line and disappeared . . . at 7.23 A.M.”’

‘In the meantime, ere the destroyer arrived, the steamer which had rescued the chief engineer and the four Chinamen had picked out of the water five more Chinamen, while, as already narrated, the patrol trawler had taken on board the

second and third engineers. In addition, the other patrol trawler had picked up two Chinamen. Three British out of twelve, and twenty-five Chinamen out of forty-four were saved ; thus, out of the whole crew of the *Conch*, twenty-eight were saved and twenty-eight were lost. The lieutenant in command of the destroyer rescued fourteen Chinamen, nine of them at the imminent hazard of his ship and all on board, by an act of skill and daring which ranks among the finest exploits of the Royal Navy.'

These histories are selected from among many hundreds of similar records. There was a staff of officers at the Admiralty engaged in docketing, classifying and summarising these documents. A room in the Admiralty was entirely lined with green boxes, arranged in alphabetical order, containing the dockets of lost ships. As the dockets increased, they were moved into a larger room. A Law Officer of the Crown, Sir Frederiek Smith, K.C. (after-

wards Lord Birkenhead), wrote a book in which he proved by the most masterly arguments that the Germans were breaking the law.

Nevertheless, the fact remained that *the great danger, then and subsequently, was lest a command of the sea, able to deny the sea to the trade of its enemy, might be increasingly unable to secure the safety of the sea for its own trade. . . . It was unable.*

Now the Paravane was designed both to destroy the submarine, and by protecting ships from moored mines laid by the submarine, to deprive it of a part of its power to injure. The urgency of the need is obvious enough. It now becomes clear why the Paravane officers felt it to be their duty to use every means, official or unofficial, to hasten the manufacture and the supply of the new gear.

The permission obtained from the Admiralty by the Paravane department to place orders for experimental purposes with private firms, was considerably stretched in practice. What else could be

done ? The situation was very serious ; the urgency instant ; and to their credit be it recorded, the private firms manifested the right spirit.

The Paravane department gave extensive orders, which the Admiralty were asked to confirm, and which they did confirm.

It should here be explained that under the Admiralty procedure of that time, to deal with experimental weapons was a part of the duties of the Third Sea Lord, and afterwards of the Controller. Weapons, or improvements in weapons, desired by *Vernon* or Ordnance or other technical departments, were ordered of private firms by the Director of Contracts. The result was that the men who made the design had nothing whatever to do with placing the order for its manufacture, so that it was impossible either that they should explain the design to the contractor or that they should superintend its manufacture in the shops.

But in the case of the Paravane, it was

absolutely essential that the designer should be in constant personal communication with the contractor, and also that he should superintend the process of manufacture, in order to solve difficulties as they arose. For when invention and production are conducted simultaneously, and there is no time adequately to test every improvement, the design of the gear must be constantly altered during its manufacture. Once more let it be recorded that the private firms employed did their utmost to help.

Thus Lieutenant-Commander P. and Lieutenant McConnel dealt directly with private firms; and Commander W. organised a special staff of some twenty officers, civilian engineers entered in the Royal Naval Volunteer Reserve, whose duty it was to superintend manufacture and to hasten its progress in the shops. Hence these officers were known as the Progress Party. The Admiralty not only approved of the arrangement but in course of time requested the Paravane Progress

Party to superintend and to hasten the manufacture of other devices.

When, in 1917, the office of Controller (unaccountably abolished before the war) was revived at the Admiralty, the bulk of the orders for Paravanes had been placed by the Paravane department. Lieutenant McConnel was then transferred to the Controller's department at the Admiralty to act as Paravane officer. By that time the Paravane department was spending millions.

XIV

WHEN Lieutenant Burney invented the Paravane, he invented what was commercially a very valuable property. But its commercial value depended upon its protection by patents. Here it should be explained that naval officers are encouraged to devise inventions by article 415 of the King's Regulations, under which all inventions made by a naval officer become the property of the Lords Commissioners of the Admiralty, who, in their discretion and as an act of grace, may grant a reward to the inventor, but who are not bound to award him anything.

In February 1915, Lieutenant Burney advised the Admiralty that the Paravane inventions should be protected by patents. Accordingly, the Admiralty Patent Agent obtained secret patents in Lieutenant Burney's name. These were lodged in

June 1915. In accordance with the King's Regulations, Burney assigned the patents to the Admiralty, under a deed of assignment, so that the Paravane patents became the property of the Admiralty, and the granting of an award to the inventor rested in the discretion of their Lordships.

Lieutenant Burney then laid before the Admiralty, in writing, his view of the position. Foreseeing the necessity of forming an immense commercial organisation for the manufacture and fitting of the Paravane, which would be furnished to H.M. ships, the ships of the Allied Navies and the merchant shipping of Great Britain and of the Allies, Burney submitted that two courses were open to H.M. Government: (1) That H.M. Government should take out patents in Allied countries, and should use the royalties thereby accruing as appropriations in aid of the Navy Estimates; (2) If that course was rejected, that Lieutenant Burney should be allowed to take out patents in Allied countries or to sell to them out-

right the drawings of the invention. Neither then nor at any subsequent time did Burney ask for an award to be granted to him by the Admiralty in respect of the fitting with the Paravane of H.M. ships ; and subsequently Burney informed the Admiralty that he would accept nothing on that account.

It will be observed that the first proposal was that the Government should work the patents and take what profit resulted therefrom ; and that the second and alternative proposal was that Lieutenant Burney should conduct the whole enterprise in terms to be decided by the Admiralty.

Their Lordships elected to choose the alternative. In a letter dated May 17th, 1916, the Admiralty authorised Lieutenant Burney to take out patents in any part of the world, at his own expense and for his own benefit, or to sell the drawings outright ; with regard to Paravanes and gear manufactured at the expense of the Admiralty and supplied by them to foreign

Governments, the Admiralty were to charge a royalty, a proportion of which would be paid to Lieutenant Burney; and with regard to the use of the apparatus by the British Navy, the Admiralty were to consider the granting of an award to Lieutenant Burney.

In that letter, therefore, the Admiralty instructed Burney, a lieutenant whose pay was about £250 a year, and who was already charged with as much work as he could well perform, to organise a system of international manufacture upon a scale requiring an initial capital expenditure of at least a million sterling.

Burney accepted the enterprise and at once began to execute their Lordships' instructions. He concluded the agreements with France and Russia, during June and July 1916. All this time he was also engaged in his work at the Paravane department at Portsmouth.

In August 1916, Burney proposed to Sir George White, of Bristol, that Sir George White should take over the whole

financial and commercial side of the enterprise. Sir George White had helped Burney to conduct his experiments with aeroplanes, during which Burney had acquired the knowledge and experience enabling him to devise the Paravane, and upon which Sir George White had expended some £10,000. Sir George White accepted Burney's proposal, and concluded an agreement with Burney under which Sir George White was to recover his initial expenditure of some £10,000 from the first payments received from foreign countries, and was to pay Burney a proportion of the subsequent profits received.

On 30th August, Burney received a letter from the Admiralty in which their Lordships, altering the arrangements they had authorised Burney to make with foreign countries, precluded the charging of royalties. As Sir George White was now in possession of Burney's rights in the matter, Burney referred the Admiralty to Sir George White. The immediate effect of the Admiralty letter was of course

to prevent Sir George White from proceeding with the business. After an interval, on October 30th, 1916, Burney received a letter from the Admiralty which, in fact, cancelled their letter of May 17th, 1916, in which Burney was instructed to conduct the whole enterprise at his own expense and (excepting in respect of the British Navy) for his own profit. The Admiralty forbade the charging of royalties to foreign countries as regards the fitting of naval vessels, and the terms and conditions of the fitting of merchant ships were to be submitted to the Admiralty for approval.

Sir George White represented to the Admiralty that if he was forbidden either to charge royalties or to receive a fixed sum in payment, he would be deprived of the means of raising the capital upon which he relied both to make up his initial expenditure already incurred, and to start the business of manufacture. These representations were made in vain. On November 22nd, 1916, Sir George

White died suddenly, and his son, Sir G. Stanley White, continued the negotiations with the Admiralty. Sir G. S. White offered to begin the work of manufacture upon condition that he received a sum in compensation for the rights withdrawn by the Admiralty. Their Lordships delaying their reply, Sir G. S. White, unable for lack of capital to build and to equip a factory, decided to transfer his rights to a firm possessing the requisite resources. He therefore assigned his rights to Messrs. Vickers, Ltd. Sir G. S. White had concluded his agreement with Messrs. Vickers, when he received a letter from the Admiralty, omitting any suggestion as to finance, but urging him to arrange to equip merchant vessels with the utmost despatch.

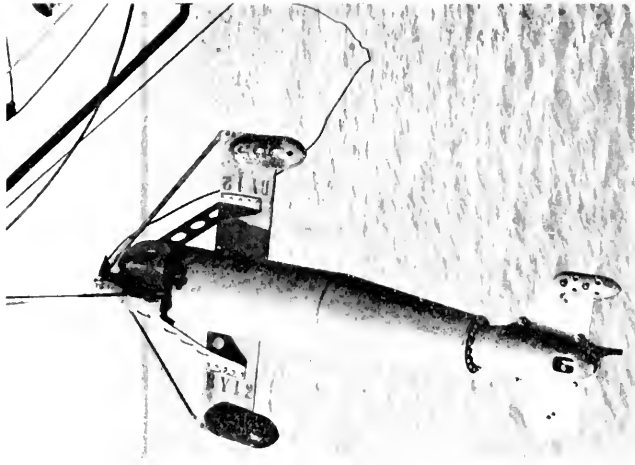
It was now the end of December 1916. So far, the commercial side of the enterprise had been entrusted to Burney upon conditions which, with the help of a private firm, made the enterprise possible; the conditions were then so altered as to make the enterprise impossible; and

Messrs. Vickers had replaced Sir G. S. White.

Messrs. Vickers, soon afterwards, at the end of January 1917, received from the Admiralty a definite order for the supply of 4000 Otters. It thus became possible, for the first time since May 1916, after the lapse of eight months, to begin the manufacture and supply of protector Paravanes on a large scale.

Here it should be stated that, by reason of the alteration by the Admiralty of the original terms laid down by the Admiralty, both Lieutenant Burney and Sir G. S. White were deprived of the monetary profits which would have accrued to them under the terms originally formulated by the Admiralty.

In a letter, dated February 23rd, 1917, the Admiralty requested Lieutenant Burney to furnish their Lordships with information as to the amounts privately expended on experimental work, such information being required in connection with the question of an award to be



AN OTTER BEING HOISTED IN

Photo. Commander G. S. Bowles



THE STANDING CUTTER ON THE TOWING-FRAME OF AN OTTER WITH THE TOWING-WIRE ATTACHED TO ITS UPPER JAW BY THE SPECIAL TOWING-SLEEVE FROM WHICH THE WIRE IS SEEN HANGING DOWN

The moorings of a mine encountered by this wire are automatically forced into the jaws of this cutter and are there cut by the serrated teeth of the knives which lie one in each jaw. With a magnifying glass these teeth can be clearly seen in the cutter jaws.

Photo. Commander G. S. Bowles

granted for the use of the Paravane in H.M. Naval Service. Lieutenant Burney, under date February 27th, 1917, replied that he desired to state that he had never asked for, and did not wish to receive, any monetary award whatever for the use of any of his inventions by the British Naval Service.

The statements which appeared in the Press, that Lieutenant Burney had received an award of £30,000, were false. Lieutenant Burney received nothing from the Admiralty.

And in a clause of the agreement concluded by Lieutenant Burney with Messrs. Vickers, it was stipulated that Burney should receive no portion whatever of any profits, direct or indirect, which Messrs. Vickers might make out of the manufacture or supply of any of the Paravane apparatus ordered by the British Admiralty for the use of H.M. ships.

The expenditure upon Paravanes supplied or approved to be supplied to H.M. ships and the ships of the United States Navy

in Home waters, was over four millions sterling. If the usual royalty of ten per cent. was charged on that sum, and if on that royalty the inventor received twenty-five per cent., he would receive £100,000.

XV

IN February 1917, at the moment when Messrs. Vickers made their arrangements with the Admiralty, the Germans began what is known as their unrestricted submarine campaign. The Grand Fleet was keeping the sea, so that the German Fleet did not venture forth; and yet the losses of British merchant ships, from 256 in 1916, ran up in 1917 to 834. In the second quarter of 1917, the British losses in gross tons were 1,361,870; the foreign losses were 875,064, a total of nearly two and a half million tons. In April, there were lost 120 British ocean-going steamships. During 1917, the average British loss was 17 vessels a week.

Before the war, the tonnage of steamships over 500 tons gross owned by the British Empire was $18\frac{1}{2}$ million tons. On 1st January 1917, it was $17\frac{3}{4}$ million tons.

But during 1917, it had dropped to $15\frac{1}{4}$ million tons, including new construction and purchases. Of this tonnage, after deducting naval and military requirements, the available tonnage for imports to this country was no more than $7\frac{1}{2}$ million tons, as compared with 12 million tons before the war. The total imports carried on British ships in 1913 was 35 million tons; nevertheless, when in 1917 the available tonnage of ships had been reduced to $7\frac{1}{2}$ millions, 31 million tons of imports were brought into this country.

But, in 1917, the bread turned a repulsive grey colour; trains of angry people ominously blackened the pavements outside provision shops; many a well-to-do citizen began to wear again clothes discarded as too tight; and the very poor, accustomed to want, feared starvation. It was, indeed, not so much actual deprivation as the dread of what might come that was the affliction. But the harrying of the haughty mistress of the seas by the unsportsmanlike boor Germany was telling.

It was not until February 25th, 1918, that the compulsory rationing of food was introduced.

In the meantime, the Paravane department, installed in the War College in Portsmouth Dockyard early in 1916, was forging ahead at full speed under Commander E. L. W.'s sure and steady guidance. The British Fleet and other navies were being rapidly fitted with the mine-protector Paravane. In the big green-painted lecture theatre of the War College, officers and ratings from the Fleet contemplated the strange, antediluvian fish-bird on the platform, and studied the illustrations of its anatomy on the blackboard. They took a five days' special course in the Paravane and returned thus illuminated to the Fleet. Some six hundred officers and some two thousand men went through the Paravane course. Officers were specially trained for Paravane work and were sent to sea for instructional purposes.

A great difficulty, now and always, was to release officers from specialist duties

at sea to take up technical work on shore. Another of the Paravane Commander's innumerable troubles was the enlistment of a sufficient staff to deal with the immense volumes of clerical work. He had, in fact, to organise the business of a huge industrial concern without the resources open to a large private firm, and without the private firm's freedom of choice, and at this time even private firms were hard put to it to get labour. Destiny, as usual, knocked at the Paravane door, and Lieutenant McConnel, who had served the Government in India, was able to secure for his department a body of patriotic Indian Civil or ex-Indian Civil servants, who volunteered their services at the exiguous naval remuneration. This admirable party were known as The Rajahs; and The Rajahs, let it be recorded in the fine French phrase, deserve well of their country. By degrees the Paravane staff came to muster over three hundred: officers, engineers, designers, draughtsmen, clerks and others. But at no time did the

department enjoy in any degree the splendid licence of the Ministry of Munitions, in which sublime department, to have it was not even necessary to ask. It had but to order. Buildings, offices, staff, thousands of staff, millions of tons of materials, everything, sprang into being, and money was nothing accounted. But the Paravane department must advance against the hydraulic pressure of a system whose pipes and conduits had for centuries been laid and multiplied to retard action until it was quite certain that the action was quite right. Throughout, the Paravane officers must devise expedients to counter the continually developing enemy submarine, which increased its diving capacity and strengthened its construction, so that the Paravane officers were perpetually striving to increase the depth at which the Paravane would run and to make stronger its explosive charge.

The trouble was that the German would not wait. He knew that *a command of the sea able to deny the sea to the trade of*

its enemy, the German, might be increasingly unable to secure the safety of the sea for its own, the English and Allied trade.

The German submarine of high speed and long sea endurance appeared. She mounted guns as well as torpedo tubes. Other German submarines laid minefields, working invisible.

Burney did not wait, either. He had urged the arming of merchant ships, and had devised a special gun for the purpose. He had invented the anti-submarine and the anti-mine Paravane. He was occupied day and night with improving and adapting the apparatus. He travelled about the country supervising fitting and manufacture. About eighty per cent. of his time was actually spent in administration and supervision, leaving the balance for the experimental work in which he was supreme. And Burney also found time to frame strategical schemes based upon the tactical employment of the new weapons.

The Germans, it is pleasant to remember,

knew less of Burney than even his fellow-countrymen knew. They knew that the Admiralty had created a new Navy of some ten thousand small craft, mine-sweepers, patrol boats, motor boats and the like ; and that in spite of all, Germany was sinking two or three ships a day.

XVI

WHAT exactly the Germans meant by unrestricted submarine warfare, may be illustrated by the following instances quoted from *The Merchant Seaman in War*.

‘On the evening of Sunday, February 4th, 1917, the steamship *Dauntless* was in the northern part of the Bay of Biscay, outward bound with a cargo of coal. At six o’clock the master and the second officer were on the bridge, keeping a vigilant watch in the clear darkness, whitened by the foam of a heaving sea. There was nothing in sight, when there came the report of a gun, and a shell sang over the bridge, and then another. One passed through the funnel, the other smashed the steering-gear, so that when the master tried to put the helm over it jammed, and the *Dauntless* went straight on. The man at the wheel was wounded

in the leg. The master was wounded in the right shoulder and left arm. Projectiles whistled from out the darkness. The ship was hit and a fireman was killed. The master stopped the ship and blew four blasts on the whistle, signifying that the ship was being abandoned. The invisible submarine continued to fire. The two lifeboats were got away under shell fire and rifle fire. Two men, one on either side the second officer, were wounded as they were embarking in the starboard lifeboat. The chief officer seems to have been in command of the port lifeboat, but there is a doubt on this point. For the moment the port lifeboat disappears, for her crew rowed away and were no more seen by the people in the master's boat. It is necessary to be particular about the boats, as will appear. We have now to do with the starboard lifeboat, in which were the master and seventeen others. One dead man was left in the ship. The master and three men were wounded.

‘It was then about half-past six. The submarine hove into view and drew alongside the master’s boat. She bore the marks of usage and her guns were rusty. Officers and men wore blue uniform. The commanding officer ordered the master and the crew on board the submarine. Then the submarine officer asked the master if there was any one left in the *Dauntless*. Upon being told that the ship was deserted, save for one dead man, the German officer ordered some of his men to go on board her in the master’s boat. He presented a revolver at the master’s head, telling him that if any one was found alive in the *Dauntless* the master would immediately be shot.

‘What the Germans were after was plunder. The men of the *Dauntless*, sullenly grouped upon the deck of the submarine, during an hour or so, contemplated the pirates bringing loot from the *Dauntless* to the submarine in the *Dauntless’s* jolly-boat, which had been left on board, and the starboard lifeboat.

The second officer saw tinned provisions, enamel paint and turpentine, among other things, handed up from the boats.

‘At about eight o’clock, when the boats were emptied, the men of the *Dauntless* gazing at the dim ship looming in the dark, saw a red flash leap from her, and heard a dull explosion, and the dim ship disappeared.

‘The submarine officer ordered the master and the crew of the *Dauntless* into the starboard lifeboat. But when the master represented that the lifeboat had been damaged by gunfire and was leaking, the German kindly allowed the master to take the jolly-boat also. The master divided the crew between the two boats. In the jolly-boat were the master, the second officer, the chief, second and third engineers, the steward and a fireman, seven persons in all. The rest went away in the leaking starboard lifeboat, which soon afterwards parted from the master’s boat, and was never seen again.

‘Already the port lifeboat had gone

away ; but her story is to come. With the starboard lifeboat we have no more to do. There remains the jolly-boat.

‘ As she parted from the submarine the master asked a German if the land was five miles away, and the German replied “ More.” There is indeed some uncertainty as to the exact position from which the boats started, as there was an increasingly easterly wind, and also there was the drift of the current in those waters.

‘ It is not known if there were provisions in the starboard lifeboat which went away and was no more seen. But it is quite certain that the Germans, having stolen all the provisions they could find in the *Dauntless*, sent the seven people adrift in the jolly-boat without food or water, in rough weather, and one of them, the master, badly wounded.

‘ The master, despite his wounded arm and shoulder, steered ; the other six men rowed, and went on rowing. The wind and sea had risen, and were dead against the easterly course steered by the master ;

the cold was extreme, with occasional storms of snow. They rowed all that night. At about six o'clock the next morning the steward fell forward, dead.

'They went on rowing all that day, Monday, without bite or sup; cold, wet, tormented by thirst, their tongues swelling, their lips black, their skins cracking with the salt spray and the bitter wind; still the five men rowed, and the dead man lay in the bottom of the boat, and the master steered.

'In the evening they committed the body of the steward to the deep. Then they sighted land. It was near nightfall; a thick shower of snow drove down and they lost the lie of the land, though it was no more than three or four miles away.

'They rowed all that night. At daylight, next morning, Tuesday, February 6th, they sighted land again, and so they went on rowing. They saw the breakers bursting all along the beach; but, wholly spent, they could do no more than keep

the boat just moving; and as her nose touched ground a wave capsized her, and the six men were flung into the surf.

‘They struggled up on the beach and fell down. Two of them, the second engineer and the fireman, then and there died on the wet sand, where they lay.

‘About half-past ten on that Tuesday morning a French coastguardsman, fully armed, was marching his lonely beat along the shore, when he saw four bowed figures stumbling towards him in the distance. A little beyond them a capsized boat was tossing in the surf.

‘The Frenchman, with admirable presence of mind, immediately decided that four German sailors had landed. He drew his revolver, and, swiftly approaching the strangers, commanded them to put up their hands. Three of them stiffly lifted swollen hands; the fourth tried to lift his arms a little. They stared upon him with faces like the faces of men in torment, and one began to speak, uttering strange sounds, thickly and slowly, framing the



A MINE WHOSE MOORINGS HAVE BEEN CUT BEING
SECURED TO THE GALLOW'S IN S.S. 'ACCRINGTON'
PREPARATORY TO HOISTING IT ON BOARD

Photo. Commander G. S. Bowles



AN OTTER BEING HOISTED IN AT THE GALLOW'S
HEAD ON STARBOARD SIDE OF S.S. 'ACCRINGTON'

Photo. Commander G. S. Bowles

same words over and over again, with a kind of pitiful desperation.

‘ And presently the French coastguardsman saw light. Ah, what a change ! And there was his little house, where the English could rest until they were taken away by the authorities to hospital.

‘ Ten days later, the master had so far recovered that he was able to leave his bed, and the second officer, the chief engineer and the third engineer were at home in England.

‘ When the six men in the jolly-boat reached land they had been adrift during nearly forty hours. That was on Tuesday, February 6th. Where, during that time, was the port lifeboat ? No one knew. All that the survivors in the jolly-boat knew was that when the boats were lowered from the *Dauntless*, the port lifeboat had gone away with four (or five) men in her.

‘ The *Dauntless* was abandoned on Sunday evening, February 4th. On the following Friday, the 9th, a Spanish

trawler, cruising in the Bay of Biscay, sighted a boat tossing in the distance. There were men in her, but whether dead or alive the Spaniard could not discern.

‘Coming alongside, the Spanish sailors looked down upon four men huddled together. Their eyes moved. Otherwise they were dead.

‘During five days and five nights they had been adrift on the winter sea. They had a little biscuit. They had no water. There were the two seaman gunners, the cook and a negro. The Spaniards landed them and they were placed in hospital.

‘After three months in hospital one of the gunners came home and made his report, which begins: “I was the gun’s crew of the *Dauntless*,” and goes on to describe his experiences in the boat in two sentences: “We drifted about in the Bay for five days. We had biscuits but no water.”

‘These four men in the port lifeboat, and the master and the three officers in

the jolly-boat, survived out of the twenty-three people of the *Dauntless*.'

'Said the third officer to the quartermaster, who was at the wheel, "James"—but that was not his name—"James," said the third officer, "I think there is a submarine on our starboard bow."

'The quartermaster's subsequent impressions were extremely crowded. The dusk of the late afternoon was thickening the easterly haze; and, staring across the long smooth swell, the quartermaster discerned the dark conning-tower and lighter hull of a submarine some two and a half miles away, and the indistinct figures of two officers on the conning-tower, and three or four men grouped on the deck. At the same time he was aware that the third officer was speaking to the captain down the voice-tube. Then a gun spoke on the submarine and a shell went by in the air. The master arrived on the bridge. So did the chief officer. The master turned the engine-room tele-

graph to stop, blew on the whistle the four short blasts signifying "Abandon ship," and ordered the boats to be swung out and manned. All these things happened very quickly. The quartermaster having run to his boat, saw a shell burst in the wheel-house which he had just quitted.

'In the meantime the master on the bridge saw the submarine sink and disappear. Watching, he saw her emerge again on the port side. She opened fire again. The master went to his cabin, possibly to fetch his confidential papers. The starboard lifeboat, which was the master's boat, had pulled clear of the ship.

'The port lifeboat was being lowered. The submarine continued deliberately to fire. It is one of the clearest cases on record of a German submarine officer continuing to fire upon a ship after she had surrendered and while the crew were getting away the boats. The boatswain and three men were severely wounded by shell splinters. A shell exploded in the

fiddley (or deck-house), setting the bunkers on fire. Paraffin oil was pouring from the stricken ship, slowly spreading a viscous surface upon the heaving waters.

‘The master came on deck to find his own boat gone, and the chief officer’s boat waiting for him, blood all about, five men huddled and helpless, splinters flying, and standing off in the twilight, the sea-wolves at their murderous work.

‘That night the boatswain died of his wounds and was buried at sea.’

‘It was February 7th, 1917, when the steamship *Saxonian* was attacked, and the crew sent adrift in open boats in the North Atlantic. (Further south, the port lifeboat of the *Dauntless* was even then drifting with four starving wretches in her.)

‘The chief officer’s boat was picked up the next morning by a patrol vessel. The second officer’s boat drifted for three days and three nights, when she was picked up by one of His Majesty’s ships. (That was on the 10th, the day after the *Dauntless’s*

survivors had been rescued by the Spanish fishermen.)

‘The patrol boat which found the chief officer and his people steamed to the scene of the capture, and there beheld a sullenly undulating field of oil, strewn with floating wreckage, the remains of the *Saxonian*.’

‘The North Atlantic (that arena of disaster), a confused swell, noon of Tuesday March 6th, 1917. The steamship *Fenay Lodge* heading towards France, a ring of haze, about ten miles in diameter, closing her in.

‘A torpedo struck her on the starboard side; the master ordered the crew into the boats, and away they went. They pulled for about half an hour, the water breaking over them, when, half hidden in the mist, the submarine emerged into view and opened fire on the deserted ship. Presently both ship and submarine were lost to sight.

‘There were twenty-seven persons in the *Fenay Lodge*, all British except one

Dutchman and one Russian. In two boats they drifted head to sea in the bitter weather, the rest of that day, Tuesday, and all that night, and the morning of Wednesday. Then, towards noon, they sighted a steamship ; pulled towards her, making signals of distress, and were taken on board. She was a French ship, the *Ohio*.

‘ The castaways had scarce shifted into dry clothing and eaten and drunk, when the *Ohio* was struck by a torpedo. She went down in three minutes. No other details are available.

‘ Half an hour after the people of the *Fenay Lodge* had been picked up they were again adrift. But five of them had been drowned in the sinking of the *Ohio*.

‘ The three boats, containing the survivors of the *Fenay Lodge* and the Frenchmen, drifted head to sea in the bitter weather for the rest of the day. About six in the evening they sighted a steamer. She bore down upon them. She was a British ship, the *Winnebago*, and, stopping alongside the tossing boats, the master

offered to take them on board. He was answered by so confused a shouting in French and English that at first he could make nothing of it. But presently he understood that the men were warning him that there were three enemy submarines about, and that they refused to be taken on board.

‘They were some two hundred miles from land, and they refused to be taken on board. The master of the *Winnebago* had done all he could; if the castaways thought open boats preferable to a stout ship, it was their affair, and he went on.

‘The men of the *Fenay Lodge* and the men of the *Ohio* drifted head to sea in the bitter weather all that Wednesday night, and all Thursday morning. At three o’clock in the afternoon a patrol boat ran up alongside and took on board twenty-two men of the *Fenay Lodge* and five officers and twenty-seven men of the French ship *Ohio*.’

‘Very early on Sunday morning, July

15, 1917, the steamship *Mariston*, homeward bound in the North Atlantic, was within about a hundred miles of land. The evidence of the manner of her loss and the sequel is the disposition of the only survivor, who was the cook.

‘When the torpedo struck the ship the cook was asleep in his bunk, in the house on the main deck. He was awakened by being hurled upwards against the ceiling, with the crash of an explosion in his ears. The mess-room steward, who was asleep in the bunk below the cook, continued to slumber, nor did he wake when the cook shook him. Already the water was surging about the cook’s ankles, and dripping through the seams of the deck above ; and the cook ran out upon the main deck, which was awash. He seems to remember seeing the apprentice following him as he doubled to the midship cabin to rouse the steward. He never reached the steward, because a second explosion, catching him on the way, blew the midship cabin to pieces.

‘ Amid the tumult, the black smoke and the pieces of the ship falling about his ears, the cook, as he ran aft, was aware of the chief gunner. The ship was sinking rapidly ; the main deck was level with the breaking sea, and the cook caught up a hatch and plunged overboard, followed by the chief gunner. Both men clung to the hatch ; the ship went down boldly, stern first ; and there came a mighty rush of water. When it had passed the cook was alone on his hatch. He never saw the gunner again.

‘ In the colourless light of an overcast sunrise the cook beheld the long, confused rollers strewn with wreckage, and counted seventeen men clinging to the pieces of the ship.

‘ Then up from the troubled waters projected two periscopes, like two horns, then the two conning-towers of the submarine, and then her long hull, shiny and black as coal, hove dripping upon the swell. To the cook she loomed as great as the five-thousand-ton ship she had just sent to

the bottom. All along her side, revealed in curves of the moving sea, waved festoons of green weed and slimy barnacles. She carried a gun forward and a gun aft.

‘ The hatch on the conning tower lifted, and there emerged a German officer. The men in the water were crying and shouting for help. The German officer surveyed the field of destruction through his glasses. Presently he dropped them, leisurely disappeared down the hatch, which shut, and the submarine began to sink. She settled steadily down, amid the cries of rage of the drowning men, until the periscopes alone were visible. Then they glided away, cutting through the seas, each square-hooded pole flirting a feather of foam. . . .

‘ The cook, tossing on his little raft, kept counting the men in sight ; and every time he counted he made the total less. Then he heard a man scream, and saw him throw up his hands ; and he saw the black fin of a shark cleaving the lop of sea, and the flash of white as the great fish turned

over to snatch its prey. The cook saw (he says) "a crowd of sharks," and heard man after man screaming as he was dragged under.

'That is all he says. It is perhaps enough. A theory may here be hazarded that the sharks followed the submarines. . . . They could make their profit of the voyage.

'As the sun rose, the wind and the sea went down on that desolation; and still the cook tossed on his hatch, until he was the last alive. He thinks it was about ten o'clock when he found himself utterly alone, except for the sharks. By that time he had been some six hours in the water.

'At about five o'clock that evening, the master of a British steamship sighted a space of sea dotted all over with drifting wreckage. He steered towards it, and passed through a field of floating timbers and fittings and packing-cases; and on its further fringe he espied the figure of a man floating on a hatch.

‘It was half-past six when the cook was hauled into the steamer’s boat and brought aboard, and revived and comforted. So he lived to tell his tale, alone of all the people in the *Mariston*.’

The case of the *Belgian Prince*, the concluding example of unrestricted submarine warfare, is peculiarly flagrant. From this instance alone, not to mention a thousand others, it is evident that after two thousand years of the teaching of Christian ethics, the educated man retains his capacity for immitigable cruelty. It may be argued, with some reason, that the object of war is to destroy the enemy, and that drowning is an easier death than burning or poisoning with gas. Nevertheless, it is the fact that war may be conducted with the humane modifications imposed by the law of chivalry. These were regarded as illogical by the Germans, as indeed they are. The code of chivalry is the saving grace of the iniquity of war. But the German creed was that war is,

not an evil but, a good in itself, and they brought their doctrine to the test. The case of the *Belgian Prince* is one of the tests. Judge, therefore, of the result.

‘Forty-three seamen of the steamship *Belgian Prince* were crowded on the deck of a German submarine, in the steely twilight of a summer night, and one, the master, was below, a prisoner. The submarine was running awash. Astern, the abandoned ship loomed momentarily more dim. In the minds of every one of those forty-three seamen there dwelt a terrible apprehension.

‘The attack on the *Belgian Prince* followed the usual routine. She was struck, without warning, by a torpedo. It was then about eight o’clock on the evening of July 31st, 1917, and the ship was two hundred miles from the north coast of Ireland. The master called away the boats, and the crew embarked, leaving the master on board to clear up his affairs. The port lifeboat put back and took him

off. The German submarine emerged and opened fire from her machine-gun upon the ship's aërials, which she destroyed. Then the commanding officer of the submarine ordered the two boats alongside, took the master on board, and sent him below, ordering all the crew on board. They were received with furious abuse by the Germans, who searched their captives, taking from them all their possessions. Money and other articles of value the pirates pocketed; other things they hove overboard. In the meantime a working party took everything out of the boats. The compasses and provisions were put into the submarine. Oars, gratings, bailers, and all loose gear were thrown overboard. The two lifeboats were damaged by axes. The plugs were removed, and they were left to sink. The master's dinghy was retained. Several Germans pulled her over to the ship, in which they remained.

‘These things the crew of the *Belgian Prince* beheld, contemplating, while they

were being violently robbed, the destruction of their last hope of escape.

‘The commanding officer of the submarine, a fair, bearded man of thirty-five or so, ordered the seamen to take off their lifebelts and place them on the deck. Then he strode along the deck, among the men, whom he cursed, kicking the lifebelts overboard. But four men, at least, contrived to hide their lifebelts under their coats.

‘From the *Belgian Prince*, in which were the Germans who had gone to her in the dinghy, a signal flashed. The submarine got under way; the captives, as already described, were crowded on her deck, as her engines slowly ground her through the water. So, for about half an hour.

‘Then there came another signal flashed from the place where the ship lay shrouded in the thickening dark. Instantly the German officer on the conning-tower disappeared, and the steel hatch clanged-to over his head.

‘The submarine began to sink.

‘The doubt haunting the forty-three seamen suddenly took shape in a certainty—the certainty of death. The water lipped upon the deck, the water covered their feet. Then they leaped into the sea.

‘The chief engineer, the cook, a Russian seaman, and the little apprentice, who had contrived to keep their lifebelts, struck out for the distant ship. The little apprentice held on to the chief engineer. The cook and the Russian were separated from the chief engineer and the apprentice, and from one another, though all were steering for where they thought the ship lay. The thirty-nine men they left were never seen again.

‘The chief engineer, holding up the apprentice, swam steadily on, resting at intervals. The boy grew heavier and heavier, his strokes weaker and weaker, and by the time the grey dawn lightened the desolate sea, he was unconscious. The ice-cold water killed him. The chief engineer went on alone.

‘He saw the *Belgian Prince*, listing over to port, when, as he reckoned, he was still a mile and a half away from her. It was then about half-past five on the morning of August 1st, 1917. The chief engineer saw a bright flame leap from the after part of the ship, saw her go down stern first.

‘The chief engineer, who makes no remark concerning his emotions at that moment, continued to swim; and presently he saw smoke on the horizon, and swam desperately towards it.

‘The cook, following his own course, also came in sight of the *Belgian Prince* about the same time as the chief engineer sighted her. He also saw the ship sink; and then he perceived the submarine, and swam away. He was picked up by the patrol boat.

‘The Russian seaman swam faster than the other two men, and actually reached the *Belgian Prince* at about five o’clock, after about eight hours in the water. For the moment, at least, he was saved; but

he was still haunted by a doubt. Numbed and exhausted, he struggled on board, shifted into dry clothing, and ate and drank. And then he saw the submarine again. She was coming alongside.

‘The Russian ran aft, and hiding himself watched the submarine stop and lie alongside, saw three or four Germans climb on board. There was nothing else for it—the Russian lowered himself into the water again, and hung on beside the rudder. For all he knew the Germans might be about sinking the ship.

‘But for the moment they were looting her, passing stores, clothing and provisions into the submarine. The Russian watched them for about twenty minutes. Then the submarine stood off and fired two shells into the ship. She broke in two and sank. The submarine dived and so departed.

‘The Russian, fighting for his life, in the swirl of water and driving wreckage, saw the master’s dinghy, which had been left adrift by the submarine. He swam

to it, climbed in, and lay there until the patrol boat picked him up.

‘There were forty-four people in the *Belgian Prince*. The crew numbered forty-two, including the master, and there were two negro stowaways. The master was taken prisoner; three were saved because they outwitted the German murderers; forty were drowned. Deprived of their boats, robbed of their possessions, stripped of their lifebelts, they were mustered on board the German submarine and drawn down to certain death.

‘Then the commanding officer of the submarine, having as he thought, slain all witnesses of his crime, returned to plunder his prey, the deserted ship. He did not know the sturdy Russian seaman was watching him from behind the rudder. Or that two more witnesses were within gunshot.

‘Whether he knew it or not, that submarine officer achieved the lowest deep of iniquity until then touched even by Germans on the sea. There may, of course,

be worse to come ; the civilised nations are hardly competent to estimate the possibilities ; but, even now, the Germans at sea have done that which shall not be forgotten till the sea runs dry.'

XVII

HAD the Navy possessed enough destroyers, the unrestricted submarine warfare, of which a few out of very many examples have been quoted, would speedily have been defeated. And for this reason : a hundred or two hundred destroyers fitted with the Paravane High Speed Submarine Sweep would have effectively countered the enemy. But in order properly to use the anti-submarine Paravane, flotillas of destroyers must be charged with that business alone, and must work in concert. But at no time during the war were there enough destroyers to spare from the Grand Fleet, or from patrol and escort duties, to be allocated to submarine hunting. Destroyers working singly did much execution with depth charges ; but investigation seems to show that, compared with the

systematic use of the explosive Paravane, depth charges are less certain in their operation.

It was therefore decided that the most urgent need was to equip vessels with the mine-protecting Paravane, which, by making harmless the mine, would defeat a great part of the submarine campaign, and which, by restoring its freedom of movement to the Fleet, would prepare for the defeat of the rest.

Early in 1917, then, while the Paravane department at Portsmouth was supplying vessels of war with the mine-protector Paravane gear, Messrs. Vickers in London began to equip the merchant ships of the world with the Otter.

What must now be done was to manufacture the Otter and its elaborate gear, and to equip with it the British and Allied merchant services. As ships could not be withdrawn from the sea for the purpose, it was necessary to fit them when they were under repair or during their stay in port between voyages. In order that the

towing wire should be attached to the fore-foot of the vessel, at the point where the bow joins the keel, it was necessary to fit every ship with a shoe, or a saddle-plate or a clump, to which were attached the towing wires of the two Otters. The requisite fitting varied with the particular build of the ship. The type of Otter-fitting required also varied with the particular type of ship, and the variation was practically covered within seven or eight standard types. Ships under construction were, of course, adapted to the Otter as they were built.

In some ships it was necessary to extend the stem itself to take the saddle-plate or sliding shoe; to others, in which the stem was much cut away, a clump was fitted; to others, a large saddle-plate was fitted. Three-strand towing wire of special design was provided. For dropping and weighing the Otter, the fittings again varied according to the type of ship. If she had no suitable derrick or davit a gallows crane was fitted. An

inhaul wire, an easing-out wire, a tripping wire and a tripping hook were provided.

It was clearly necessary to catch each vessel as she entered port and to fit her there and then. For that purpose, Otters and gear must be ready in the port, with a skilled staff to fit them.

When the Otter was fitted to the ship it was necessary to teach the crew how to use it.

There were two sides to the organisation for fitting merchant ships with the Otter: the Admiralty and Paravane department side, and the manufacturing and commercial side, which belonged to Messrs. Vickers. Under the Defence of the Realm Act, the Admiralty made compulsory the fitting of merchant ships with the Otter, the cost of which was defrayed by the State; so that the Admiralty were clearly responsible for ensuring that the gear was rightly fitted. Lieutenant - Commander (now Commander) E. A. D., Royal Navy, at the suggestion of the Paravane Com-

mander, was therefore appointed to supervise the whole business. Commander E. A. D. had previously relieved Lieutenant V. H. D. of the charge of supervising the fitting of His Majesty's ships, and from the end of 1916, Commander E. A. D. was assisted in that duty by Lieutenant Y. H. F. G. W., Royal Navy, who, his eyesight having been affected by continuous strain at sea in command of a destroyer, had come on shore. In March 1917, when Messrs. Vickers had received orders to fit merchant ships, Commander E. A. D., by degrees leaving the naval fitting to Lieutenant Y. H. F. G. W., began to organise the fitting of the merchant service.

Commander E. A. D. represented that first of all Messrs. Vickers must be enabled to examine the way in which ships were fitted with the gear, and it was therefore arranged that Messrs. Vickers' men should receive the requisite instruction from the Paravane department at Portsmouth, without charge. It was also arranged

that all Messrs. Vickers' designs for fitting the gear should be submitted to the Paravane department to ensure that the working of the gear should be efficient. Commander E. A. D. also represented that it was necessary to train a number of officers who should superintend the actual fitting of each vessel, who should conduct trials of the gear when it was fitted, and who should instruct officers and men in the handling of the Otter. For this purpose, Royal Naval Reserve officers were very wisely selected, as being at once conversant with both the Royal Navy and the Mercantile Marine. Six R.N.R. officers were at once appointed for these duties, and the number of R.N.R. officers eventually increased to about fifty. Commander E. A. D. organised the whole of this branch, found suitable offices for the R.N.R. officers, and distributed them among the ports.

These inspecting officers, working with Messrs. Vickers, inspected every ship on her arrival in port, supervised her fitting,

conducted trials, instructed her officers and men, made arrangements that at least one officer in each ship should go to Portsmouth to attend a demonstration of the working of the Otter, went to sea with the ship when she left port, helped in getting out the Otter, and then returned (usually coming back with the pilot) to begin again. The R.N.R. officers also kept in communication with ships fitted with the Otter which came into port, collecting the opinions of their officers as to the practical working of the gear. Between sea and office, these officers worked day and night, very often without going to bed for several nights in succession.

At Portsmouth, the merchant service officers sent down by the R.N.R. inspecting officers at the ports, received a one-day's course of instruction in the training steamship *Accrington*. In the morning they attended lectures on the Otter, and in the afternoon they witnessed the actual cutting of dummy mines by the Otter. Sometimes the day's party would

number fifty masters and mates. In all, some six thousand merchant service officers took the course. Apart from the valuable instruction they gained, the demonstration served to convince the conservative British seamen, as nothing else would have convinced them, that the Otter was really a practical weapon.

In organising a system of intelligence under which the arrival of ships in port could instantly be ascertained, Commander E. A. D. received every help from the Naval Transport Officers, under the Director of Transport, which official acted as liaison officer with the Ministry of Shipping. Commander E. A. D.'s department was thus enabled to inform Messrs. Vickers, who also had their own system of intelligence, of the movements of ships.

The Admiralty and Paravane department side of the fitting of merchant ships was thus complete. After some months, when about a thousand ships had been fitted, the organisation had become so

extensive that the Paravane Commander at Portsmouth proposed that the Otter section should be separated from the Paravane department, and should become a branch of the Trade Division at the Admiralty, or of the Ministry of Shipping. The suggestion was approved; the Otter department was duly constituted; and early in 1918 it occupied offices overlooking St. James' Park; though under what department of the Admiralty the Otter department was placed, seemed a trifle uncertain. But the Otter department remained under the conduct of Commander E. A. D., who, in making it, had performed services so inestimable.

Lieutenant Y. H. F. G. W., who had been in charge of the fitting of naval ships, came from Portsmouth and joined the staff of Commander E. A. D. as his senior assistant.

Subsequently, Commander E. A. D., his health having been affected by the immense and continuous strain of his work, was compelled to retire. Commander

E. A. D. had first joined the Paravane department in the summer of 1916. An ex-naval officer and a barrister, he had rejoined the Service with the rank of Lieutenant-Commander. He was immediately plunged into the new, complicated and difficult enterprise of fitting naval ships, under the Paravane Commander; and then he tackled the whole business of organising and supervising the fitting of the merchant service of Great Britain with the Otter. These vessels were voyaging on every sea, touching port, unloading and loading again and departing under the utmost stress of urgency. The ships were of various types, and for each type a special fitting must be designed, made, and fitted. Officers and men must be persuaded of the necessity of the Otter, and there and then trained in its use. It was a tremendous task: it was triumphantly achieved.

Upon the financial side, Commander E. A. D. was admirably assisted by Mr. E. P. Burke, who came from Lieutenant-

Commander McConnel's branch, and who was an ex-Indian Civil Servant. On the technical side, Lieutenant-Commander P. (E) of the Paravane department gave invaluable help.

The present writer has not the privilege of the acquaintance of these gentlemen ; so that it may not be improper to set down the reflection, how little the country, and how little the Government, know of their best servants.

The manufacturing and commercial side of the Otter department was conducted by Messrs. Vickers, who have very kindly given the present writer a description of its organisation and operation.

Be it remembered that at this period of the war every private firm was choked with Government work, and that skilled men were hard to find. Messrs. Vickers began by appointing a local agent in each port. They made arrangements with various other firms to manufacture and supply the parts and gear of the Otter. They devised a system under which the



TAKEN FROM THE FORECABIN OF S.S. 'ACCRINGTON'
LOOKING AFT ALONG HER STARBOARD SIDE

The ship is under way and her starboard Otter has just cut the mooring of a submerged dummy mine at which the ship was directly steered. The mine has been flung away from the ship, its moorings have then reached the cutter on the Otter and have been cut, and the mine is here seen leaping to the surface well clear of the ship's side.

Photo. Commander G. S. Bowles



AN OTTER BEING HOISTED OUT OVER PORT SIDE OF
S.S. 'ACCRINGTON'

Photo. Commander G. S. Bowles

parts should be assembled, the Otter completed, and sent down to the testing stations at Weymouth and Milford Haven. Every Otter was tested at sea before being fitted. When it had been tested and passed, it was despatched by rail whither it was wanted.

Conceive the organisation required. It was necessary to know at all times the stage of the process to which each type of Otter had been brought, to allocate the various types to the various ships as the ships came in, and to get the particular Otter required to the particular ship requiring it at the right moment.

Therefore, together with the organisation of the manufacture and supply of Otters, it was necessary to devise a system of intelligence under which Vickers' head office learned what ships were due at each port, when they were due and how long they would remain in port. For this purpose, a large clerical staff was engaged and was trained in the use of an ingenious card index system. At one time, news of

the arrival of a ship was received every quarter of an hour, day and night ; and as the news came in, it was recorded in the card index, and every movement of the ship and each process of fitting was followed in the card index, so that at any moment the condition of any given ship was known. It was thus possible to begin to fit a ship at one port and to finish her at the next.

As the organisation grew, Messrs. Vickers installed their own staff at each port. The country was divided into districts and each was placed in charge of an official, who was responsible for the work in his district. Stations were established on the Continent and in the United States.

At first, the work was a perpetual conflict with every sort of obstacle : deficiency of labour, difficulties of transport, difficulties in communication ; and throughout the business must be carried through at high speed. The staff at Vickers' headquarters worked day and night. Wholly unknown to fame, they were one with the

fighting services in their single aim to win the war. All depended on the sea; it was the business of Vickers' staff to do their part to prevent that *great danger, lest a command of the sea able to deny the sea to the trade of its enemy might be increasingly unable to secure the safety of the sea for its own trade.*

Combining this enterprise with his work in the Paravane department, the indefatigable Burney was everywhere, inventing, supervising and organising as requisite.

Some fifty firms were employed in manufacturing Otters and gear under Messrs. Vickers. At Messrs. Vickers' head office, the Otter staff numbered about 180; about 60 men were employed in fitting, about 50 men in testing, and about 40 men in inspection work. Ships were fitted at 32 ports in Great Britain: Blackwall, King's Lynn, Newhaven, Southampton, Plymouth, Falmouth, Cardiff, Barry, Newport, Avonmouth, Swansea, Milford Haven, Liverpool, Manchester, Barrow, Workington, Belfast, Dublin, Queenstown, Govan,

Dundee, Aberdeen, Leith, Bo'ness, Newcastle, Blyth, Middlesboro', Sunderland, West Hartlepool, Hull, Goole and Grimsby. There were four stations in the Mediterranean : Marseilles, Malta, Alexandria and Port Said.

Messrs. Vickers' representatives assisted the United States Government and the United States Shipping Board to fit American and British vessels at the following ports, among others : New York, Philadelphia, Providence, Norfolk, New Orleans, Baltimore, Newport News, Boston, Seattle, Cleveland.

The average number of ships fitted per week for the six months preceding the Armistice was 50. The average number of ships per week repaired was 120, and inspected, 280. The number of Otters manufactured was over 17,000.

The first merchant vessel was equipped with the Otter in April 1917. When the Armistice was concluded, about 3000 ships had been fitted with the Otter.

The secrecy maintained was extra-

ordinary. Outside the sea services and those engaged in the work, very few persons, during the war and even afterwards, had ever heard of Paravane or of Otter. Which circumstance indicates that what is omitted from the newspapers is not known. On one occasion at least, an Otter was washed up on the beach in this country ; Otters were lying about at railway stations ; hundreds of men and women were employed in making parts of Otters and their gear, packing, despatching and fitting them ; yet the Otter was kept secret.

XVIII

THE result of fitting the protector Paravane to H.M. ships was that sixty-eight men-of-war cut mines: seven battleships, two battle cruisers, two cruisers, fifty-three light cruisers, three armed auxiliary cruisers and one minelayer; the most of which, it is reasonable to assume, would in default of the Paravane have been lost.

Before the Otter was fitted to merchant ships eighteen vessels a month were being lost by mine. After the Otter was fitted the losses dropped to three or four, and in some months none, *and no merchant ship fitted with the Otter was lost by mine.* Thirty-four British merchant ships were known to have been saved, and thirteen not certainly known, forty-seven in all, to which must be added a large number not reported by the master. Foreign merchant ships are not included.

The total tonnage of H.M. ships saved is 525,333 tons of an estimated value of £52,533,300.

The total tonnage of merchant ships *known* to have been saved is 240,078 tons, of an estimated value of £9,603,120, to which must be added the estimated value of cargoes, £13,000,000. To these figures must be added a large margin for cases of mines cut and not reported, and *all* cases of mines cut by Allied vessels.

The immense saving of life also accomplished is not to be expressed in terms of money.

The following official record has been furnished by the courtesy of the Board of Admiralty.

The following statistics have been compiled with a view to showing the successes of the Paravanes (both explosive and protector types) and Otters, fitted to H.M. ships and to the merchant service respectively. The returns are the official Admiralty records.

No detailed information has yet been obtained as to the results of the apparatus fitted to foreign vessels of war and merchant ships, although it is known by verbal reports that three American ships of war were saved, including the *South Carolina*, one of the latest Dreadnoughts.

There are instances also, like the attack on Durazzo, which are not included. At Durazzo a very considerable number of mines were cut, and the attacking forces came unscathed through two mine-fields.

As the resources of the Allies in shipping were pooled, the amount of tonnage saved by the Allies was of vital importance, and it is therefore considered that in estimating the *total* cost of shipping saved, the cost of foreign tonnage saved should be computed.

Cases have occurred of masters refusing to sail until the Otter gear was in perfect working condition, thus causing valuable time to be wasted, and it can be safely recorded that captains of H.M. service

and masters of the merchant service have relied upon the gear to protect them from mine attack. The moral value of a sense of security should be added to the commercial value.

It will be seen from the following statistics that the total tonnage saved by the protector Paravanes and Otters respectively is :—

		tons.
Paravanes (H.M. ships)	. .	525,333
Otters (merchant ships)	. .	240,078

If the average value per ton for H.M. ships be taken at £100 and a low average value for merchant ships, the following figures are obtained :—

Value of H.M. ships saved	. .	£52,533,300
Value of merchant ships saved	. .	9,603,120
		<hr/>
Total	. .	£62,136,420
		<hr/>

In this figure of £62,136,420 no amount has been included for the cost of the cargo carried by merchant ships, so that the

saving to the Allied countries of food-stuffs and material at a time when they were practically irreplaceable, is not shown.¹

Ships which have been saved more than once have been counted in value more than once, as they would have been replaced by some other vessel. It cannot be taken that upon every occasion when a mine is cut, the ship was necessarily saved, but as it is only during the daytime that the mines when cut are seen, it may be safely assumed that the mines which are cut at night and which are not reported, compensate for the uncertain factor. It should also be considered that masters often do not report a cut.

The extent of their omissions may be estimated by noting that where reporting is accurate, as in the British Navy, out of approximately 180 ships fitted with the gear, reports of 55 cuts have been

¹ Owing to the large number of cases of mine cutting unreported, as already explained, the figure is far from the real total.

obtained, whereas, *out of 2720 merchant ships fitted with Otter gear, only 44 reports have been received.*

The results of the use of the explosive Paravane are in part doubtful, for it is only in exceptional cases that definite proof can be obtained, and the submarine logged as 'Known Sunk.'

In estimating the value of the Submarine Sweep, the 'Known Sunk' cases only have been taken into consideration.

The number of submarines which have been classified as 'Known Sunk' is 205, and it will be seen from the following statistics that the Paravane accounted for five of this number, or approximately two and a half per cent.

The total damage done by enemy submarines has been estimated at approximately £1,000,000,000; so that the value of the tonnage sunk by one submarine is approximately £5,000,000. The value of the Paravane service was, therefore, approximately £25,000,000.

The total value of the whole Paravane

252 THE PARAVANE ADVENTURE

service may, therefore, be summarised as follows :—

Submarine Sweep	.	.	£25,000,000
Protectors	.	.	52,533,300
Otters	.	.	9,603,120
Total	.	.	<u>£87,136,420</u>

and to this figure must be added the cost of the cargo saved by Otters which may be reckoned as £13,000,000. It will thus be seen that the Paravane Service has saved the British Empire approximately £100,000,000. If full reports were available, that amount, as already explained, would be greatly increased.

This is a purely financial estimate, taking no account of the many hundreds of lives saved.

XIX

THE results of the use of the Paravane and Otter completely justified the Paravane officers. They had achieved their long, difficult and incredibly arduous enterprise. They had matched their wits against the craft of the enemy and had won. The submarine was defeated, both actually and potentially. The occupation of the mine-laying submarine was gone. By reason of the lack of destroyers, the High Speed Submarine Sweep had not been used on a great scale ; but its efficiency had been demonstrated. The Paravane officers had done their part in saving the British Fleet and the British Mercantile Marine.

In 1917, Lieutenant Burney received from His Majesty the King the honour of Companion of the Most Distinguished Order of Saint Michael and Saint George, and was promoted to the rank of Acting-Commander. Lieutenant Bowles was pro-

moted to the rank of Commander (Emergency). Another officer received the Order of the British Empire. So far as the present writer has been able to ascertain, the services of the other Paravane officers have not received the expression of official approval.

But during their long months of toil and anxiety, they had no thought of reward. The officers of the Regular Navy among them, in the circumstances, were indeed conceivably hazarding their career in the Service. The temporary officers were simply working for their country. When the work was done, when the adventure had been triumphantly accomplished, they dropped back into civil life, contented that they had done well what they took in hand to do. If Burney was the moving spirit, the other Paravane officers were the cheerful and indefatigable pioneers of the adventure, who made possible its success.

In this business, as in others, the experience of the war demonstrated that the Navy, regarded as a system, was governed

by a tradition which both prevents the recognition of modern conditions of warfare and hinders action in emergency. Admiral of the Fleet Viscount Jellicoe's history of the Grand Fleet during the first two years of the war illustrates, on the one hand, the appalling defects of the system, and on the other, the superb conduct of the naval officer within the limits to which the system restricted him.

To be quite plain, the system let the country down, down to the very edge of disaster. What saved the country? The heroic labours of officers and men, of which Lord Jellicoe tells, and, among other enterprises, the Paravane adventure. But is the country to rely in the future upon forlorn hopes led by gallant individuals, in despite of the system?

¹The Navy has become a profession of many highly specialised branches, each of which owes its development to the achievements of science on shore. Side by side

¹ The substance of what follows appeared in *The National Review*, June 1919.

with that development, the old tradition under which the Navy of masts and sails was independent of the shore, except (in the old phrase) for victuals, wood, and water, survives. There were instances during the war of extremely capable naval officers who, taken from the sea to organise the invention and application of some particular device urgently required, were as totally ignorant of the persons from whom to seek advice and assistance, and of the existing state of things in relation to his requirement, as if they had landed in another planet. While naval warfare, like land warfare, had become an affair of applied science, the Navy had remained aloof from civilian enterprise and unconscious of the march of events. There existed no department at the Admiralty whose business it was to study the invention and the application of modern weapons in collaboration with civilian investigators. The Navy had its own experimental establishments, and these (it considered) should suffice. There was H.M.S. *Excellent*, the gunnery



TAKEN FROM THE FORECASTLE-HEAD OF S.S. 'ACCRINGTON'
AT SPITHEAD, LOOKING AFT ALONG HER STARBOARD SIDE

Showing the gallows fitted for hoisting and lowering an Otter ; and the inhaul wire leading from it to the Otter running below the water.

Photo. Commander G. S. Bowles



TAKEN FROM THE FORECASTLE-HEAD OF S.S. 'ACCRINGTON'
AT SPITHEAD, LOOKING AFT ALONG HER PORT SIDE

Showing the gallows fitted for hoisting and lowering an Otter ; and the inhaul wire leading from it to the Otter running below the water.

Photo. Commander G. S. Bowles

school on Whale Island ; there was H.M.S. *Vernon*, torpedo school, an old wooden ship-of-the-line ; there were the *Actaeon* torpedo school ships, a group of old hulks, lying between Sheerness and Chatham ; and so on. Within the limits to which they were restricted, the officers of these establishments did admirably.

But the naval experimental establishments, compared with the great installations of private firms, were insignificant. A proportion of the most talented naval officers, whose advancement in the Service, after attaining the rank of commander, depended upon seniority, commonly leave the Navy to enter private firms. Were they to remain in the Service and to obtain promotion, they would be charged with the sea and administrative duties of a senior officer, and their particular ability would be wasted. Hence it is that the senior officers of the Navy, to whom is confided its direction, are but dimly aware of any developments in gunnery, torpedo, mining, wireless, and the like, occurring since they

were promoted, while the authority of the young officers who know what the Service can teach of these things, and how to use them, is strictly limited by their rank. Officially, the ability, like the authority, of an officer is estimated by the number of gold rings on his sleeve.

Moreover, in whatever the ability of an officer consists, the Service ordains that a condition of his promotion is that he puts in a certain proportion of sea-time, as it is called. Here is another survival of custom which has lost its reason ; for in the sailing days the main qualification for command was, naturally, experience in seamanship. Now that many other qualifications are equally essential, an officer must spend at sea time in which he seldom acquires any additional knowledge of seamanship whatever. There are, of course, many officers who are seamen and nothing else, and who are quite content with that noble branch of their profession. But even for the salt-horse, it is not necessary that he should be sent to a naval preparatory

school on shore at the age of thirteen, and that he should thenceforth regard the beach and the inhabitants thereof as having been created by the Almighty in a fit of absence of mind, and therefore to be regarded with pity and treated with kindness by the naval officer.

The theory that the Navy is still constantly at sea and cruising, as it used to cruise fifty years ago, for three years or more at a stretch, is still entertained by the authorities. In accordance with that tradition, officers obtained a very scant allowance of leave.¹ Although conditions have totally changed, the idea is that in a ship in full commission, perpetually cruising, an officer cannot possibly be spared for longer than ten days or a fortnight without grave injury to His Majesty's Service. Hence it is that if an officer desires to improve his knowledge generally or in particular, he must apply to go on half-pay, thereby both injuring his chances of promotion and making it almost impossible for him to pay his way.

¹ Since extended.

Civilians who encounter the naval officer during his brief sojourns on shore regard him with the slightly nervous admiration due to one who deals familiarly with formidable mysteries, and who is generally reputed to be able triumphantly to handle any emergency, ashore or afloat. But if the civilian ever dared to interrogate his hero in what examiners call general knowledge, he would be surprised at the ensuing vacuity.

So long as the Navy was a cruising Service, in whose ships guns were mounted as a matter of form—delightful conditions under which the senior admirals of to-day entered the Navy—the quaint monasticism of the seaman was merely charming. To-day, when the Navy is a complex of applied sciences, when the ships are floating towns crammed with engines of destruction and are driven by fuel which must be replenished every week or so, when they are longer in port than at sea, the extraordinary isolation of the naval officer is simply foolish. Its result, during the war,

was to bring this country into a danger which the public have not yet understood.

Surely it is time that the naval officer were treated like a reasonable being ? If we take the analogy of the Army, we observe during the war civilians becoming generals and commanding armies with notable success. In the Navy itself we perceive thousands of 'hostilities only' men, civilians entered straight from the shore, performing admirable service. It almost seems as if there was something in the civilian, after all. Nevertheless the public are still solemnly impressed with the notion that the Navy is a great and a holy mystery, only to be apprehended by initiation in childhood, and that the practice of its craft demands the unremitting devotion of the ascetic.

As a matter of fact, this is all nonsense. There is no reason why the naval officer should become so exclusive a specialist that he knows nothing outside his own profession, and very often nothing outside his own particular branch of it. The Navy

owns an unexpressed sense of injury because the public do not appreciate it. How in the world can the public appreciate what they are not allowed to know? You do not find the recluses of a monastery annoyed because they are forgotten by a godless civilisation. Doctors, lawyers and soldiers, simply because they are a part of society, do not consider that they are misunderstood by society. And why should not the naval officer be a part of society? That is really the question the present writer ventures to ask. After many years' observation of naval affairs he is drawn to the conclusion that a very much happier and a very much more satisfactory state of things might be created by a few simple changes.

All naval cadets should be entered from the public schools and grammar schools. Osborne could then be abolished, to the saving of much money, not to mention anxiety. As for Dartmouth, that institution could become the first stage of the cadet, before he goes to sea. A certain

number, if not all, but preferably all, sub-lieutenants and lieutenants should be sent to the Universities for at least a year.

The officers specialising in engineering could then go to Keyham College for a three or five years' course. At the same time, qualified civilian engineers should be invited to enter the Navy direct. Why not? Engineer-officers are always wanted, and there they are. Nothing but the mystery theory bars them from the Service, with the result that the Navy never has enough engineer-officers.

Royal Naval Reserve officers entering the Navy should be eligible for promotion above the rank of commander. Royal Naval Volunteer Reserve officers, many of whom did excellent service in the war, should be allowed to enter the Regular Navy.

The Royal Naval College at Greenwich, in which noble establishment certain courses for young officers are now provided, should be made the headquarters of naval

education proper. Greenwich, in the phrase of one among its presidents, who effected many excellent reforms there, the late Admiral Sir John Durnford, should become the University of the Sea. In the great chambers of that palace there is room enough for an ample establishment for every branch. What is lacking is the initiative of the authorities. And so little is the potential value of the Royal Naval College understood that the other day a Member of Parliament actually suggested its abolition.

The traditional system of promotion in the Service should be reformed from top to bottom. Many years ago Lord Beresford suggested that the tremendous responsibilities of an admiral could seldom be properly discharged by old men. But apart from the matter of age, under the present system the senior officers speedily lose knowledge of current developments, and are removed from the practice of the special branch in which they are most competent. Moreover, the

greater proportion of naval officers are debarred from promotion for the simple reason that there are many more junior than senior officers required at any given moment. The path to the top narrows as it ascends. Many lieutenant-commanders must retire with the rank of commander and disappear into civil life, of which they know hardly anything, with no provision save a small pension. Some of them own technical knowledge which gains them a lucrative post, but these are the few. Among them are officers whom the Navy cannot afford to lose, but whose services, owing to its ridiculous system, it is obliged to forfeit. For the rest, it is merely the duty of the State to give every officer and man in its service full opportunity for fitting himself to earn a competent livelihood in the civil life to which, except in the minority of cases, he must presently return. That opportunity can never be given so long as the dissociation of the Navy from civil life is jealously maintained. The alternative is to grant

a handsome pension, like the Indian Civil Service.

The entrance of a selected number of naval officers into the Universities has given to them their first acquaintance since childhood with the men and affairs of the shore. One result will be that if the Navy fails to offer advantages equivalent to the advantages of a civil career, the supply of competent naval officers in the future will diminish.

The experience of the War dissipated the pleasant delusion that the Navy was wholly self-sufficing and completely organised to deal with any emergency. For when the emergency arrived, the first thing the Navy was compelled to do was to create a new Navy out of civilian material. The civilians pulled it out of the ditch. The same thing happened to the Army, with this difference, that nobody of any intelligence imagined that the little Regular Army could fight a European war. What the Regular Army did was to sacrifice itself to gain time while the civilian army was a-preparing.

Had the enemy fought the war at sea with any spirit, the Navy would have been obliged to consummate the same sacrifice.

If preparation for war be in question, the association and interchange of naval and civilian affairs would still be essential. But the immediate need is to establish a reasonable relation between the two which shall benefit both. It is sometimes said (with an accent of despair) that reform will come, if it ever comes, from below—that is, from the Labour people. The event is highly improbable, for the more notorious demagogues manifest not the smallest interest in the matter, of which indeed they are profoundly ignorant. Nor is there any reason to imagine that an industrial and a mechanical civilisation, which corrodes intellect, is likely to emit from its lower layers any light other than the angry glow of discontent.

At the same time, it is a melancholy reflection that the series of statesmen who have occupied the position of First Lord have never even been aware that any need

for reform existed. It is true that the Sea Lords would hardly enlighten them. In the presence of these tremendous silences the present writer is conscious of what will probably be regarded as unforgivable audacity. But, after all, he did not set the yeast in the dough. It is there, and it is working.

This is a matter in which the country as a whole is concerned, for its security and its prosperity alike must still depend upon the sea services, and until a common understanding prevails between seamen and landsmen there can be no unity of purpose.

Imperceptibly, the days of the exclusive service have gone by, and the sooner the change is brought into the region of consciousness the better.

Nothing can correct the impression produced upon the mind of the landsmen by some of the recent literature dealing with the life of the Navy, except personal acquaintance with that Service, nor can aught persuade the naval officer that life on shore has its own intrinsic values,

except becoming for a time a part of that life. The naval officer is not really the kind of person depicted in those stories about the Navy in which he is represented as a compound of profound sentimentality and romantic heroism, speaking a strange dialect, invariably addressing his friends by curious nicknames, and romping like a child at every opportunity. This singular conception is like to misfeature the Navy, as Ouida's Guardsmen, in the sumptuous Victorian Age, misrepresented the British Army. Those great creatures did high credit to Ouida, and as heroes of fiction they demand homage, but they did not in fact embody the type of the British Army.

The Navy enlists every variety of character, ability and temperament, and it needs them all. But as at present constituted, it appears that the Service itself prevents itself from giving due scope and verge to the talents with which it is endowed. In the old sailing-ship days a ferocious discipline was, fortunately, diver-

sified by a startling indulgence. As the ships changed from creatures whose life was the wind of God and the will of man, to monstrous mechanisms of steel, so the administration of the Service became more and more mechanical. From a free company the Navy became a factory. When the man becomes the servant of the machine he is on the way to death. A mechanical system of administration kills by degrees, and presently there is nothing left but the system. And then . . . ?

APPENDIX

PROTECTOR PARAVANES

THE following is a chronological list of occasions officially reported to the Admiralty upon which a mine mooring is known or believed to have been cut on service by the Paravane Gear of H.M. Ships.

DATE.	SHIP AND CLASS.	TONNAGE.	CHARACTER OF MINE.		CHARACTER OF CUT.		
			German.	British.	Certain.	Probable.	Doubtful.
1917							
16 Mar.	CAMBRIAN, Lt. Crsr.	3,750	1	..	1	..	..
1 June	SHANNON, Crsr.	14,600	1	..	1	..	..
30 July	GALATEA, Lt. Crsr.	3,500	..	1	1	..	..
19 Sep.	ALSATIAN, A.M. Crsr.	18,481	1	..	1	..	..
19 Sep.	ALSATIAN, A.M. Crsr.	18,481	1	..	1	..	..
11 Nov.	UNDAUNTED, Lt. Crsr.	3,500	1	..	1	..	..
16/19 Nov.	EMPEROR OF INDIA, Battleship	25,000	1	..	..	..	1
20 Dec.	CARDIFF, Lt. Crsr.	4,190	1	..	1	..	..
22 Dec.	MINOTAUR, Crsr.	14,600	1	..	..	..	1
1918							
26 Jan.	ROYALIST, Lt. Crsr.	3,500	..	1	1	..	..
2 Feb.	VALIANT, Battleship	27,500	1	..	..	..	1
16/17 Feb.	PRINCESS ROYAL, B. Crsr.	26,350	1	..	..	..	1
26 Feb.	ERIN, Battleship	23,000	1	..	1	..	..
	Carry forward . .		11	2	9	..	4

THE PARAVANE ADVENTURE

DATE.	SHIP AND CLASS.	TONNAGE.	CHARACTER OF MINE.		CHARACTER OF CUT.		
			German.	British.	Certain.	Probable.	Doubtful.
	Brought forward . .		11	2	9	..	4
1918							
4 Mar.	PATUCA, A.M. Crsr.	6,103	1	..	1	..	..
23 Mar.	ANGORA, Minelayer	4,293	1	..	1	..	..
26 Mar.	SKIRMISHER, Lt. Crsr.	2,895	1	..	1	..	..
31 Mar.	FORWARD, Lt. Crsr.	2,850	1	..	..	..	1
8/11 Apr.	MALAYA, Battleship	27,500	1	..	..	..	1
8/11 Apr.	MALAYA, Battleship	27,500	..	..	..	..	1
14 Apr.	VALIANT, Battleship	27,500	1	..	..	..	1
27 Apr.	CENTAUR, Lt. Crsr.	3,750	1	..	1	..	..
13 May	CANTERBURY, Lt. Crsr.	3,750	..	..	1	..	..
13 May	CANTERBURY, Lt. Crsr.	3,750	..	..	1	..	..
13 May	CLEOPATRA, Lt. Crsr.	3,750	..	..	1	..	..
13 May	CLEOPATRA, Lt. Crsr.	3,750	..	..	1	..	..
13 May	CLEOPATRA, Lt. Crsr.	3,750	..	..	1	..	..
13 May	COVENTRY, Lt. Crsr.	4,190	..	..	1	..	..
13 May	CURACOA, Lt. Crsr.	4,190	..	1	1	..	..
13 May	CURACOA, Lt. Crsr.	4,190	..	1	1	..	..
24 May	CARDIFF, Lt. Crsr.	4,190	1	..	1	..	..
28 May	FURIOUS, Lt. Crsr.	19,100	1	..	..	1	..
29 May	FURIOUS, Lt. Crsr.	19,100	1	..	..	1	..
29 May	CLEOPATRA, Lt. Crsr.	3,750	1	..	1	..	..
31 May	CURACOA, Lt. Crsr.	4,190	1	..	1	..	..
31 May	CONCORD, Lt. Crsr.	3,750	1	..	1	..	..
31 May	CENTAUR, Lt. Crsr.	3,750	1	..	1	..	..
31 May	COVENTRY, Lt. Crsr.	4,190	1	..	1	..	..
31 May	COVENTRY, Lt. Crsr.	4,190	1	..	1	..	..
31 May	COVENTRY, Lt. Crsr.	4,190	1	..	1	..	..
1 June	CURLEW, Lt. Crsr.	4,190	1	..	1	..	..
1 June	CARDIFF, Lt. Crsr.	4,190	1	..	1	..	..
1/2 June	FURIOUS, Lt. Crsr.	19,100	1	..	..	1	..
6 June	BIRKENHEAD, Lt. Crsr.	5,235	1	..	1	..	..
6 June	BIRKENHEAD, Lt. Crsr.	5,235	1	..	1	..	..
6 June	BIRKENHEAD, Lt. Crsr.	5,235	1	..	1	..	..
12 June	COVENTRY, Lt. Crsr.	4,190	1	..	1	..	..
12 June	CONCORD, Lt. Crsr.	3,750	1	..	1	..	..
13 June	GALATEA, Lt. Crsr.	3,500	1	..	1	..	..
13 June	CENTAUR, Lt. Crsr.	3,750	1	..	1	..	..
13 June	CENTAUR, Lt. Crsr.	3,750	..	1	1	..	..
14 June	CANTERBURY, Lt. Crsr.	3,750	1	..	1	..	..
	Carry forward . .		39	5	40	3	8

DATE.	SHIP AND CLASS.	TONNAGE.	CHARACTER OF MINE.		CHARACTER OF CUT.		
			German.	British.	Certain.	Probable.	Doubtful.
	Brought forward . .		39	5	40	3	8
1918							
14 June	CANTERBURY, Lt. Crsr.	3,750	1	..	1	..	..
14 June	CANTERBURY, Lt. Crsr.	3,750	..	..	1	..	..
26 June	COURAGEOUS, Lt. Crsr.	18,600	1	..	1	..	..
28 June	PHAETON, Lt. Crsr.	3,500	1	..	1	..	..
28 June	UNDAUNTED, Lt. Crsr.	3,500	1	..	1	..	..
29 June	CURACOA, Lt. Crsr.	4,190	..	..	1	..	..
8 July	CLEOPATRA, Lt. Crsr.	3,750	1	..	1	..	..
9 July	REPULSE, B. Crsr.	26,500	1	..	1	..	..
9 July	PHAETON, Lt. Crsr.	3,500	1	..	1	..	..
1 Aug.	CLEOPATRA, Lt. Crsr.	3,750	1	..	1	..	..
4 Aug.	GLASGOW, Lt. Crsr.	4,800	1	..	1	..	..
19 Aug.	CERES, Lt. Crsr.	4,190	1	..	1	..	..
22/24 Aug.	EMPEROR OF INDIA, Battleship	25,000	1	..	..	1	..
28 Aug.	SOUTHAMPTON, Lt. Crsr.	5,400	1	..	1	..	..
1 Oct.	SOUTHAMPTON, Lt. Crsr.	5,400	1	..	1	..	..
19 Oct.	PHAETON, Lt. Crsr.	3,500	1	..	1	..	..
5 Dec.	CARDIFF, Lt. Crsr.	4,190	1	..	1	..	..
	Total . .	583,713	54	5	56	4	8

OTTERS

The following is a list of the occasions on which mines have been cut by merchant ships fitted with Otter gear, and the fact has been reported officially. Definite evidence of the mine having been cut existed except in the cases where marked with an asterisk.

DATE.	SHIP.	TONNAGE.	POSITION.	REMARKS.
1917				
16 July	HUNSWORTH	2,991	Off St. Albans Head	Mine came to surface
11 Sep.	HUNSWORTH	2,991	Off The Shambles	
July	*GRANTULLY CASTLE	7,612		Wire presumed cut from state of blades
13 Sep.	HUNSWORTH	2,991	Off Trevose Head	Led to discovery of new minefield
13 Sep.	GORSEMOOR	3,079	Off Kirkenek, Mediterranean	In company with H.M.S. <i>Harrier</i>
15 Sep.	*HUNTSCRAFT	5,113	Between Havre and Cowes	Night. Presumed cut from state of blades
13 Sep.	WILLIAM MIDDLETON	2,543	Off Pendeen	Known minefield
24 Sep.	Unknown	4,000 (?)	Off Trevose Head	Reported by drifter <i>Livelihood</i>
27 Sep.	FERNANDINA	1,851	3 miles S.S.W. of The Shambles	Cut German mine Type IV.
8 Oct.	BRODLIFFE	5,893	Between the Smalls and Grassholme, Pembroke Bay	Discovered new minefield
9 Oct.	THISTLEMOOR	6,506	3½° W. by W. Beachy Head	Mine came to surface 100 ft. from ship
13 Oct.	*MELTONIAN	6,306	Off Lamdash	Wire presumed cut from state of blades
19 Oct.	POPLAR BRANCH	5,391	51° 30' N., 4° 21' W.	Cast off her gear. Mine in tow

DATE.	SHIP.	TONNAGE.	POSITION.	REMARKS.
1917 22 Oct.	*MERCHANT	3,918	Between Liver- pool and Glas- gow	Wire presumed cut from state of blades
25 Oct.	LAKE MANITOBA	9,674	Between Belfast and Liverpool	Night-mine moor- ing found foul of Otter
11 Nov.	GREGYNOG	1,701	Off Trevoise Head	9 A.M. cut mine adrift. Otter brought in mine moorings and fit- tings
12 Nov.	USKMOOR	3,189	4 miles N. by E. Bardsley	
14 Nov.	*GLENART CASTLE	4,000 (?)	Outside Mersey	Wire presumed cut from state of blades
4 Dec.	MANCHESTER MARINER	4,106	50° 04' N., 4° 49' W.	Otter exploded mine
13 Dec.	*CITY OF ORAN	7,784	Between N.W. of Ireland and Mersey Bar	Wire presumed cut from state of blades
21 Dec.	WARDOG	3,046	Between Nash Point and Sear- weather	Chain and deton- ator of newly-laid mine brought in
1918 24 Jan.	HUNTSLAND	2,871	4 miles from Owers. 50° 33' N., 0° 41' W. bearing S.W. 4 W. Mag.	Cut mine
24 Jan.	HUNTSLAND	2,871	Do.	Cut mine
24 Jan.	*JUSTITIA	32,234	Between The Maidens and Mersey Bar	Wire presumed cut from state of blades
24 Jan.	*CARMANIA	19,524	Between Over- say and Mersey Bar	Do.
25 Jan.	ARIADNE	1,986	50° 05' N., 4° 47' W.	Cut a mine and sunk it by rifle fire
30 Jan.	ALEXANDRA TEESBRIDGE	3,898	Off Syra, Greeian Archipelago	Cut during night. Patrol picked up mine in morning on vessel's track
1 Mar.	*HONORIUS	3,476	Between Mersey Bar and Nash Point	Wire presumed cut from state of blade
9 Mar.	OLYMPIA	5,138	In vicinity of Royal Sovereign Light Vessel	

DATE.	SHIP.	TONNAGE.	POSITION.	REMARKS.
1918 15 Mar.	KORA	817	5 miles S.E. New-haven Light-house	Cut a mine: sunk by gunfire from T.B. 5
22 Mar.	TEAKOL	4,000 (?)	56° 35' N., 2° 23' W.	Mine sunk by gunfire
14 Apr.	*MORENGO	4,000 (?)	Off St. Catharine's Road	Wire presumed cut from state of blades
3 May	SWAINBY	5,811	52° 55' N., 4° 40' W.	
8 May	QUILOTTA	3,692	50° 45' 20" N., 0° 03' 50" E., Hope Point	Mine rose to surface: discovered new minefield
10 May	BADAGRI	2,952	Off Sierra Leone	
12 May	BENLAVERS	3,949	52° 55' N., 4° 2' W. (Approx.)	
3 July	*EXMOOR	4,329	In Schipino Channel, Grecian Archipelago	Wire presumed cut from state of blades. Teeth broken
24 Sep.	*NIRVANA	6,021	Approaches to Havre, 49° 44' N., 0° 29' W.	Otter came into ship's side. Teeth of cutter blades broken
29 Sep.	PLASSY	7,346	Off Long Island, New York. Lat. 40° 48' N., Long. 70° 33' W.	Mine sighted passing the stern. Cutter blades marked
6 Oct.	*DOGRA	5,138	On passage to Bizerta	At night mine not seen, but condition of blades and behaviour of Otter indicated mine cut
8 Nov.	GOORKHA	6,335	Off Kavale	Cut mine in daylight. Mine seen on surface alongside
14 Nov.	GOORKHA	6,335	Dardanelles	Cut mine and passed through minefield
14 Nov.	GOORKHA	6,335	Dardanelles	Do.
14 Nov.	GOORKHA	6,335	Dardanelles	Do.

EXPLOSIVE PARAVANES

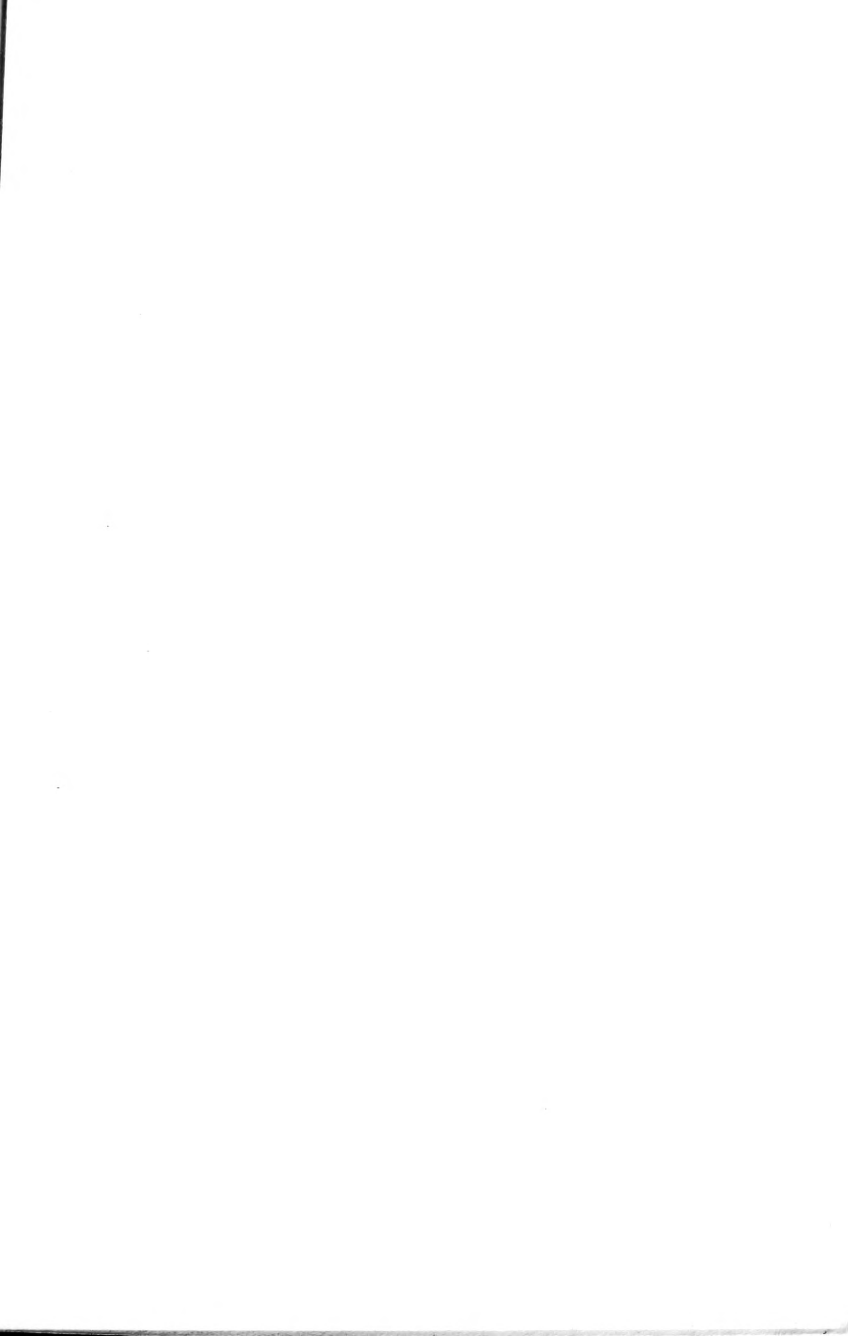
The following is a chronological list of occasions officially reported to the Admiralty upon which Explosive Paravanes have fired on service; showing also, for each such occasion, the official classification of its result.

DATE.	SHIP AND CLASS.	OFFICIAL CLASSIFICATION.			
		Possibly Slightly Damaged.	Probably Seriously Damaged.	Probably Sunk.	Known Sunk.
1916					
18 Mar.	MEDUSA, T.B.D.	..	..	..	..
27 May	MATCHLESS, T.B.D.	..	1	..	..
18 July	ACHERON, T.B.D.	..	..	..	..
26 July	FIREDRAKE, T.B.D.	..	..	..	..
13 Aug.	LAVEROCK, T.B.D.	..	..	..	..
9 Sep.	LUCIFER, T.B.D.	..	..	..	..
11 Sep.	PATRIOT, T.B.D.	..	1	..	..
28 Nov.	LAVEROCK, T.B.D.	..	..	..	..
28 Nov.	LINNET, T.B.D.	..	..	..	..
6 Dec.	ARIEL, T.B.D.	..	..	..	..
16 Dec.	ACHATES, T.B.D.	1	..	..	..
30 Dec.	PATRICIAN, T.B.D.	..	..	..	..
1917					
27 Feb.	EXE, T.B.D.	1	..	..	..
9 Mar.	MARVEL, T.B.D.	..	1	..	..
12 Mar.	MEDEA, T.B.D.	..	..	..	1
13 Mar.	FIREDRAKE, T.B.D.	..	..	..	..
23 Mar.	HIND, T.B.D.	..	..	..	..
29 Mar.	MUNSTER, T.B.D.	1	..	..	..
13 Apr.	PEREGRINE, T.B.D.	..	..	..	..
16 Apr.	ROSALIND, T.B.D.	..	..	..	..
17 Apr.	RELENTLESS, T.B.D.	..	..	..	..
19 Apr.	SURPRISE, T.B.D.	1	..	..	..
26 Apr.	HIND, T.B.D.	..	..	..	..
2 May	MURRAY, T.B.D.	..	..	..	..
16 May	NAPIER, T.B.D.	..	..	..	..
25 May	ACASTA, T.B.D.	1	..	..	..
Carry forward . .		5	3	..	1

DATE.	SHIP AND CLASS.	OFFICIAL CLASSIFICATION.			
		Possibly Slightly Damaged.	Probably Seriously Damaged.	Probably Sunk.	Known Sunk.
	Brought forward . .	5	3	..	1
1917					
3 June	ACHATES, T.B.D.	1	..	..	..
10 June	LOOKOUT, T.B.D.	..	..	..	..
15 June	Motor Launch 143	1	..	..	..
18 July	OPHELIA, T.B.D.	..	..	..	..
28 July	TAURUS, T.B.D.	..	..	..	..
5 Aug.	OWL, T.B.D.	..	..	..	..
19 Aug.	READY, T.B.D.	..	..	1	..
20 Aug.	TORRENT, T.B.D.	..	..	..	..
17 Sep.	ACASTA, T.B.D.	1	..	..	..
23 Oct.	MELAMPUS, T.B.D.	..	..	..	1
13 Nov.	FIREDRAKE, T.B.D.	..	..	..	1
15 Nov.	ORIOLE, T.B.D.	..	..	..	..
17 Nov.	LANCE, T.B.D.	..	..	..	..
30 Nov.	RETRIEVER, T.B.D.	..	1	..	..
1918					
8 Jan.	CYCLAMEN, Sloop	..	..	..	1
4 Feb.	SHIELDRAKE, T.B.D.	1	..	..	..
26 Feb.	ACHERON, T.B.D.	..	..	..	..
12 Mar.	DEFENDER, T.B.D.	..	..	..	..
1 Apr.	LINNET, T.B.D.	..	..	..	..
22 Apr.	T.B. 81	..	..	..	..
24 Apr.	OPERON, T.B.D.	..	..	..	..
2 May	Motor Launch 486	..	..	..	..
17 May	THRUSTER, T.B.D.	1	..	..	..
27 May	Motor Launch 213	1	..	..	..
19 July	SUGI, Japanoso T.B.D.	..	..	..	..
20 Sep.	DEE, T.B.D.	..	..	..	..
4 Oct.	P. 33	..	..	..	1
	Totals	11	4	1	5



D
21
100



**THE LIBRARY
UNIVERSITY OF CALIFORNIA
Santa Barbara**

**THIS BOOK IS DUE ON THE LAST DATE
STAMPED BELOW.**

UC SOUTHERN REGIONAL LIBRARY FACILITY



AA 000 291 872 0

